

UNIVERSITY OF KENTUCKY
WATER RESOURCES INSTITUTE
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SELECTED
 WATER
RESOURCES
ABSTRACTS

VOLUME 1, NUMBER 5
MAY 1968



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Washington, D. C. 20240**

**SELECTED
WATER RESOURCES ABSTRACTS**

VOLUME 1, NUMBER 5

MAY 1968

**UNITED STATES DEPARTMENT OF THE INTERIOR
WATER RESOURCES SCIENTIFIC INFORMATION CENTER**

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WATER RESOURCES SCIENTIFIC INFORMATION CENTER

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R202709X68A TECHNICAL MEN IN GOVERNMENT

The Federal Government employs more technical manpower than any other organization in the world. A recent attempt to count the number of Federal installations where these scientists and engineers work only resulted in an estimate that there were thousands of laboratories scattered among 25 Agencies and Departments. Living and working conditions in this immense bureaucracy are indicated. The overriding impression is one of great conformity and an excess of attention to climbing the administrative ladder. Good work is done, but with 80% of the Federal research budget contracted to industry and universities, most technical men in Government spend more of their time on frustrating paper shuffling than professional work.

ADMINISTRATION
AND MANAGEMENT

R202709X68A

Marcson, Simon

TECHNICAL MEN IN GOVERNMENT

Sci Technol, No 73, pp 62-68 & 85, Jan 1968. 6 p, 1 illus, 9 ref

Rutgers--The State University, New Brunswick, N J

DESCRIPTORS-/ *technologists/ *scientific personnel/ administration/
*engineering personnel/ laboratories/ research and development/
industries/ *professional personnel/ universities/ management/
*government employees

IDENTIFIERS-- / *Federal Agencies/ Civil Service Commission/ *careers

R202723 68A PERFORMANCE APPRAISAL INTERVIEW BEHAVIOR

The purpose of performance appraisal is to gain an evaluation of each employee's job performance by examining his capacity for future development rather than by concentrating on his past performance. The performance appraisal interview is a tool whereby management is able to point out the particular acceptable or unacceptable elements of an employee's work or work habits before either the organization or the employee loses too much. The goal of the interview is not to change an individual's personality but to improve his job performance. Effectiveness of the interview depends on the behavior of both the supervisor and the employee. General guidelines for such interviews include suggestions on how to: (1) keep them on a conversational level, (2) provide enough time and a minimum of disturbances, (3) avoid tension by acting natural, (4) listen and talk quietly without being on the defensive, and (5) be relaxed and self-confident. Success or failure should not be judged by the social tone, amount of conversation, or the personality differences exposed. Important factors of the interview are the degree of communication achieved and the clarity of criticism, thus enabling an employee to further improve his work performance.

R202723 68A

Smith, John P

PERSONAL BEHAVIOR IN THE PERFORMANCE APPRAISAL INTERVIEW

Advance Manage J, Vol 33, No 1, pp 56-62, Jan 1968. 7 p

Newark College of Engineering, N J

DESCRIPTORS-/ *behavior (psychology)/ management/ supervision/ time/
psychology/ *personnel management/ employee relations/ human behavior/
efficiencies/ reasoning/ human engineering/ *communications/ environment

IDENTIFIERS-/ listening/ goals/ personality/ *interviews/ *performance/
performance rating/ clarity/ evaluation

ADMINISTRATION AND MANAGEMENT

R202769X67A THE MANAGER'S GUIDE TO SYSTEMS ANALYSIS
Systems analysis, as defined by the authors, is the application of operations research methods to determine whether in any complex mechanism all facets of that mechanism can or will achieve the purpose intended with economy of design and operation. Furthermore, systems analysis requires a clearcut relationship between need and design and between achievement and purpose. The authors have developed a systems analysis checklist to help managers judge the worth of a new system concept. The checklist is not intended to show how to design a system but to enumerate the factors contributing to a good systems design. The checklist questions are divided into 2 groups. The first concerns technical factors external to systems design; the second, internal factors. External factors include establishing need, defining objectives, identifying constraints, and validating assumptions. The internal factors include selecting system elements and evaluating the trade-offs. The systems study is concluded with a final appraisal to determine that internal factors satisfy external factors and how well the system design will function under guidelines established by external factors.

R202769X67A

Block, A C; Broner, M A; Peterson, E L

WHAT'S GOING ON HERE--THE MANAGER'S GUIDE TO SYSTEMS ANALYSIS

Manage Rev, Vol 56, No 12, pp 4-14, Dec 1967. 11 p, 1 illus

Lockheed Missiles & Space Co, Sunnyvale, Calif

DESCRIPTORS-/ *systems analysis/ *operations research/ *methodology/ decision making/ management/ correlation techniques/ requirements/ feedback/ coordination/ analysis/ measurement/ collecting method/ models

IDENTIFIERS-/ *management planning/ *systems engineering/ objectives/ evaluation/ constraints

R202780X67A HOW TO MAKE PEOPLE LISTEN

Clear, effective oral reports are the product of an orderly mind, a knowledge of human behavior, and frequent objective appraisal of results. Formal and informal oral communications are important to the average business day. Confidence and competence in this area not only make each individual's participation in a meeting more effective but are necessary requisites to career advancement. Seven practical suggestions to improve oral communications with coworkers include: (1) evaluate the participants and the occasion to provide direction and focus to the material presented; (2) identify the purposes, listing them in order of importance, and orienting the report to this end; (3) organize and outline the report; (4) make and use efficient notes; (5) create a good self-image by analyzing appearance, grooming, and mannerisms; (6) control the voice for most effective use; and (7) use eye communication and watch for feedback from listeners.

R202780X67A

Guncheon, June

TO MAKE PEOPLE LISTEN

Reprint, Nation's Business, Oct 1967. 4 p

DESCRIPTORS-/ management/ *communications/ values/ analysis/ feedback/ concentration/ coordination/ efficiencies/ work/ *preparation/ applied psychology/ conferences/ motivation/ psychology/ reasoning/ planning/ employee relations

IDENTIFIERS-/ listening/ professional advancement/ reports/ professional development/ *oral reports/ performance/ clarity

R202720X67A NITROGEN FERTILIZER LOSS FROM RUNOFF

AGRICULTURE

An experiment conducted at the Southern Indiana Forage Farm using a rainfall simulator evaluated the effect of surface cover, initial soil moisture content, and surface soil structure on the amount of fertilizer nitrogen lost in surface runoff water. Results indicated that nitrogen losses occurred from ammonium nitrate pellets applied to the surface of either sod or fallow when conditions were such as to produce high rates of surface runoff. While fallow soil may retain surface-applied nitrogen fertilizers better than sod under comparable runoff conditions, erosion losses of organic nitrogen are much more severe. Measured losses of mineral nitrogen in these experiments were low, even at the intense rate of rainfall studied. The greatest loss amounted to only 15% of the applied fertilizer nitrogen after 5 in. of rainfall. However, with the increased usage of nitrogen fertilizers anticipated in the future, nitrogen content of surface runoff water could become a significant contributing factor to nitrate pollution of surface water supplies. Further work is being conducted to evaluate nitrogen losses associated with other nitrogen carriers and other management practices.

R202720X67A

Moe, P G; Mannerling, J V; Johnson, C B

LOSS OF FERTILIZER NITROGEN IN SURFACE RUNOFF WATER

Soil Sci, Vol 104, No 6, pp 389-394, Dec 1967. 6 p, 3 fig, 1 tab, 11 ref

Purdue University Agricultural Experiment Station, Lafayette, Ind

DESCRIPTORS-- / *fertilizers/ *nitrogen/ *nitrates/ *rainfall/ raindrops/ rainfall intensity/ runoff/ *surface runoff/ crops/ agronomy/ slopes/ agriculture/ soil science/ infiltration/ soils/ water quality/ stream pollution/ water pollution/ artificial precipitation/ soil moisture

IDENTIFIERS-- / ammonium nitrate/ rainfall simulators

R202753X67A PROTECTIVE COATINGS FOR RIVER STRUCTURES

CHEMICAL
ENGINEERING

A 7-yr investigation was conducted in the USSR to find paint and varnish coatings providing long and reliable protection against corrosion of hydraulic equipment. Chlorinated polyvinyl chloride, ethynolic, and epoxy coatings are recommended for preventing corrosion on submerged mechanical equipment. Recommended protective coating systems and costs are given. Tests on antifouling paints indicated that a widely used oil-resin base paint was unsatisfactory and a new chlorinated polyvinyl chloride paint had good antifouling properties. In selecting protective coatings, not only the operating conditions must be considered but also the maintenance and repair conditions during the prescribed service life. The more durable and expensive coatings are economically advantageous under difficult and costly maintenance operations.

R202753X67A

Chesnokov, B S; Gurevich, Yu M; Litvak, M L, et al

PAINT AND VARNISH COATINGS FOR PROTECTING MECHANICAL EQUIPMENT FOR RIVER HYDRAULIC STRUCTURES AGAINST CORROSION

Hydrotech Constr, No 3, pp 243-247, Mar 1967. 5 p, 3 tab

DESCRIPTORS-- / *protective coatings/ *corrosion control/ hydraulic gates and valves/ hydraulic structures/ *maintenance/ materials testing/ mechanical equipment/ *paints/ varnishes/ clams/ epoxies/ costs/ field tests/ durability/ laboratory tests/ organic compounds/ enamels/ metalwork

IDENTIFIERS-- / polyvinyl chloride/ product evaluation/ foreign testing/ USSR/ antifouling coatings

CONCRETE TECHNOLOGY

R202770X68A CEMENT HYDRATION & CONCRETE FORM PRESSURE

The pressure of concrete on forms as affected by cement hydration and individual concrete ingredients was studied. The effect of cement hydration was isolated by comparing form pressures developed by concrete with a similar but nonhydrating mixture having the same plastic properties as concrete. Oil-filled pressure cells were used to measure form pressures. Tests indicate 3- to 4-in. slump concrete does not behave as a fluid for any appreciable time without some outside energizing force such as vibration. The arching action of aggregate is the earliest factor limiting development of form pressure. Hydration of cement was the next factor to limit form pressure; however, revibration substantially increases form pressure until about 4 hr after placement. The nonhydrating mixtures develop higher form pressures than concrete. Water-reducing, set-retarding admixtures only slightly lower form pressures developed by concrete. The duration, magnitude, and location of the vibratory effort are more important than any other factors considered in development of form pressure and should be consistent with form design.

R202770X68A

Ore, Elwood L and Straughan, J J

EFFECT OF CEMENT HYDRATION ON CONCRETE FORM PRESSURE

J Amer Concrete Inst, Vol 65, No 2, pp 111-120, Feb 1968. 10 p, 6 fig, 2 tab, 2 ref, disc

Bureau of Reclamation; Ken R White Co, Denver, Colo

DESCRIPTORS-- / concrete/ concrete mixes/ *concrete placing/ admixtures/ concrete technology/ *forms (concrete)/ laboratory tests/ *pressure gages/ lateral forces/ pressures/ fly ash/ aggregates/ vibrations/ instrumentation/ test procedures/ slump

IDENTIFIERS-- / *cement hydration/ concrete properties/ set-retarding agents

CONSTRUCTION

R202754X67A CONSTRUCTING LARGE DIVERSION TUNNELS

The construction of concrete-lined diversion tunnels at Nurek, Toktogul', and Charvak Hydroelectric Projects in Central Asia is described. The Nurek No 1 and Toktogul' tunnels are horseshoe-shaped; the Charvak tunnel has an 11-m-dia circular section. Geologic conditions at the tunnel sites are described briefly, and details are given on tunneling operations and construction costs. Self-propelled mining equipment has cut labor costs in half and increased the quality and rate of construction. With the present equipment, tunnels of cross sectional area greater than 80 sq m are best driven in 2 stages: the top section first with crown concrete and then the bench section. The construction rate of large tunnels is slow because of concreting operations. Lag in concreting operations results from faulty design and lack of standardized tunnel sections. Standardized tunnel sections would permit mechanization of the lining operation. A horseshoe-shaped section with an extended arch abutment is most suitable, even for pressure tunnels. Horseshoe section tunnels are better suited to 2-stage construction, permit organization of a 2-way traffic system, and can be built more quickly and at lower cost than circular sections.

R202754X67A

Mnatsakanov, L N; Kuperman, V L; Kel'mi, A M

EXPERIENCE IN THE CONSTRUCTION OF LARGE-SECTION HYDRAULIC TUNNELS

Hydrotech Constr, No 3, pp 210-221, Mar 1967. 12 p, 11 fig, 5 tab, 1 ref

DESCRIPTORS-- / diversion tunnels/ foreign projects/ concrete placing/ *foreign construction/ *tunnel construction/ tunnel design/ tunneling/ *tunnel linings/ tunnels/ reinforced concrete/ engineering geology/ mechanization/ rock excavation/ cross sections/ drilling equipment/ construction costs/ construction

IDENTIFIERS-- / rock properties/ *concrete linings/ Nurek Project, USSR/ Toktogul' Project, USSR/ Charvak Project, USSR/ blasting

R202755X67A CONSTRUCTING UNDERGROUND STRUCTURES

The problems associated with improving methods of constructing underground hydraulic structures in the USSR are discussed. Construction of hydraulic tunnels in the USSR evolved in the 1930's. Problems of planning and designing a lining are examined, and a table is given of basic data on linings of large hydraulic tunnels in the most characteristic rocks. Experience has shown that a horseshoe section is most acceptable for temporary diversion tunnels. Research (hydraulic and structural) being conducted on underground structures in the USSR is discussed. The fastest tunneling rate in the USSR was on the Toktogul' tunnel (796 m long with a face area of 150 sq m), completed in 30 working months. This rate was achieved by opening 6 faces. A specialized organization was formed to do the entire complex of underground construction, and results over the past 5 yr indicate this was a sound decision.

R202755X67A

Kuperman, V L

PROBLEMS OF IMPROVING METHODS OF CONSTRUCTING UNDERGROUND HYDRAULIC STRUCTURES

Hydrotech Constr, No 3, pp 202-209, Mar 1967. 8 p, 2 tab, 3 ref

DESCRIPTORS- / *underground structures/ underground powerplants/ rock excavation/ *tunneling/ *tunnel construction/ tunnels/ tunnel linings/ construction/ construction costs/ *hydraulic structures/ earthquakes/ diversion tunnels/ hydroelectric powerplants/ foreign construction/ excavation/ tunnel design/ tunnel hydraulics
IDENTIFIERS- / USSR/ construction methods/ underground openings

R202757 67A TEHAMA-COLUSA FISH BARRIER

A dual-purpose irrigation and fish spawning channel will be constructed along a 3.22-mi length of the Tehama-Colusa Canal, California. A vertical slide gate device (baffle gate) was developed for cleaning the gravel spawning bed of the canal. The gate can be moved along the length of the canal and positioned in the water to produce a jet of higher velocity flow beneath the gate. A secondary use of the baffle gate is to provide a 5-fps velocity barrier for controlling movements of small fish in the canal. Model tests were made to determine whether this velocity barrier could be maintained without eroding the gravel bed and to determine baffle gate settings to produce the 5-fps velocity barrier for given discharges. A photograph and drawing of the model flume, test data, and a gradation curve of model gravel are included.

DAMS AND HYDRAULIC STRUCTURES

Zeigler, E R

R202757 67A

AN ARTIFICIALLY PRODUCED VELOCITY BARRIER FOR CONTROLLING FISH MOVEMENT: TEHAMA-COLUSA CANAL

Bur Reclam Lab Rep Hyd-579, Hydraul Br, Nov 1967. 26 p, 14 fig, 4 tab, 1 ref

Bureau of Reclamation, Denver, Colo

DESCRIPTORS- / *fish/ irrigation canals/ hydraulic models/ model tests/ *fish handling facilities/ scour/ baffles/ velocity/ channels/ slide gates/ flumes/ jets/ gravels/ canals/ hydraulic structures
IDENTIFIERS- / Tehama-Colusa Canal, Calif/ *spawning channels/ *fish guiding/ *fish barriers/ salmon

DEMINERALIZATION

R202734X67A REVERSE OSMOSIS DESALTS BRACKISH WATER

Field tests of the POGO reverse osmosis test unit were conducted on brackish water in Midland, Fort Stockton, and Kermit, Texas, and San Diego, California. Brackish water in Texas is high in sulfates and carbonates; San Diego water is high in iron and manganese and virtually saturated with sulfates and carbonates. The POGO unit is described briefly, and details are given on operating procedures, measurements, and test results. The tests in Texas showed reverse osmosis can produce a high quality product water with reasonable recovery from brackish water of high sulfate and carbonate content. Tests at San Diego are still in progress but show reverse osmosis can desalt brackish water of high iron and manganese content with reasonable recovery rates by using control measures. Adjusting feedwater pH below 6 inhibits carbonate scale formation. Carbonate scale can be removed by acid treatment and flushing. Sulfate scale can be inhibited by chemical additives and removed by mechanical means such as flushing. Precipitation of iron and manganese compounds can be inhibited by reducing feedwater pH below 6 and minimizing aeration of feedwater.

R202734X67A

Larson, T J

PURIFICATION OF SUBSURFACE WATERS BY REVERSE OSMOSIS

J Amer Water Works Ass, Vol 59, No 12, pp 1527-1548, Dec 1967. 22 p, 10 fig, 4 tab, 5 ref

General Dynamics Corp, San Diego, Calif

DESCRIPTORS./ *demineralization/ brackish water/ water supplies/ ground water/ field tests/ scale/ carbonates/ sulfates/ iron compounds/ feed water/ manganese compounds/ membranes/ water analysis

IDENTIFIERS./ *reverse osmosis/ scale prevention/ scaling/ Midland, Tex/ Fort Stockton, Tex/ Kermit, Tex/ San Diego, Calif/ *POGO unit

DRAINAGE AND GROUND WATER

R202718X67A WATER WELLS IN CORROSION ENVIRONMENTS

Some 30,000 irrigation wells are being installed in the Indus Basin Irrigation System of West Pakistan to provide drainage for waterlogged lands and irrigation supplies for cultivated land. Mild steel casings and screens were originally specified, as the ground water analysis did not indicate a corrosion hazard. Within 2 yr, approximately 10% of the first group of wells showed a marked decline in yield caused by corrosion and encrustation of screens. The intensity of the attack was related to sulfate-reducing bacteria. Search for a material to withstand the corrosive environment and still not appreciably affect the overall cost of the well led to selection of fiberglass reinforced epoxy resin pipe. Fiberglass pipe meets or exceeds all established criteria for well casing. About 900 wells have been constructed with fiberglass casing since 1965. No difficulties were encountered in shipping or installation. Although the initial cost of fiberglass casing was about 4 times the cost of mild steel casing, experiences in working with fiberglass and manufacturing advances lowering production costs have eliminated any increase in overall costs of completed wells.

R202718X67A

Smith, Don K

AN ECONOMIC DESIGN FOR WATER WELLS IN CORROSION ENVIRONMENTS

Amer Inst Mining, Met Petrol Engs Annu Meeting, Los Angeles, Calif, Pap 67I83, Feb 1967. 9 p, 1 ref

Tipton & Kalmbach, Inc, Denver, Colo

DESCRIPTORS./ *well casings/ *well screens/ *wells/ irrigation systems/ *drainage wells/ drainage systems/ ground water/ waterlogged land/ glass fibers/ corrosion/ epoxies/ plastics/ plastic tubing/ water analysis/ foreign projects/ economies/ composite materials/ foreign construction

IDENTIFIERS./ irrigation wells/ Indus Basin, Pakistan/ West Pakistan/ *fiberglass plastic pipes/ plastic pipes/ sulfate-reducing bacteria

R202724X67A ECONOMICS OF TUBE WELL DEVELOPMENT

In preparing for a large program of ground water development in the Punjab area of Pakistan, situations arose in which the choice between 2 or more alternatives was made by analyzing the economic implications of critical hydrologic parameters. Two of these situations are of interest to ground water hydrologists. The first involves basic development policy--whether ground water development should be based on the demand of the economy or the conservation concept of safe yield. The analysis demonstrated that mining of ground water is clearly indicated for areas where alternative supplies are unavailable. The second problem involves integrating hydrologic data into an economic model to determine optimum well design. From an analysis of all pertinent factors, a simple nomograph was derived to determine well specifications onsite during construction. The nomograph can be modified for use in any alluvial terrain.

R202724X67A

Mao, S W; Hildebrand, P E; Crain, C N

THE INTERDEPENDENCE OF ECONOMIC AND HYDROLOGIC CRITERIA IN PLANNING
WATER RESOURCES DEVELOPMENT

Amer Inst Mining, Met Petrol Engs Annu Meeting, Los Angeles, Calif,
Pap 67190, Feb 1967. 20 p, 6 fig, 3 tab

Tipton & Kalmbach Inc, Denver, Colo; University of Denver, Colo

DESCRIPTORS--/ water resources/ *ground water/ economics/ water costs/
water development/ project planning/ pumps/ aquifers/ pumping plants/
irrigation/ water table/ *wells/ costs/ well screens/ optimum design/
models/ nomographs/ hydrology/ water yield

IDENTIFIERS--/ Pakistan/ pumping/ *tube wells/ economic evaluation/ water
wells

R202745 67A GROUND WATER RECHARGE THROUGH WELLS

During recent years more than 100 million cu m of ground water recharge were injected in over 100 wells in Israel. In wells of limestone-dolomite aquifer, recharge rates exceeded 2 cu m/hr during prolonged uninterrupted periods. Performance of the recharge wells was very satisfactory. Experience showed that recharging a well with free-falling water could have unsatisfactory results because of air being sucked into the well during the process. When the inflow of water stopped, air and water were emitted violently from the well casing. Care must be taken in wells where the limestone aquifer is directly overlain by layers of loose sand. When injected water rose in loose sand and dropped upon stoppage of injection, subsidence of the ground occurred, causing loss of the well. Recommendations are made for adequate injection procedures and well construction, and various types of installations used in the recharge operations are described. Installations differ in cost and injection rates; choice of installation type depends on the need and type of operation. Various techniques are compared, and a proposal is made for a standardized economical installation to be used in wells for pumping and recharging.

R202745 67A

Sternau, R

ARTIFICIAL RECHARGE OF WATER THROUGH WELLS. EXPERIENCE AND TECHNIQUES

Symp Int Union Geod Geophys-Int Ass Sci Hydrol, Haifa, Israel, pp 91-
100, Mar 1967. 10 p, 7 fig

DESCRIPTORS--/ *groundwater recharge/ injection/ land subsidence/ air/
aquifers/ limestones/ dolomites/ collapsing/ pore water pressures/ well
casings/ pressure distribution/ water table/ hydraulic gradients/ sands/
*wells/ *ground water

IDENTIFIERS--/ Israel/ *artificial replenishment/ pumping/ suction

DRAINAGE AND GROUND WATER

R202747 67A MEASURING HYDRAULIC CONDUCTIVITY
Recent developments for measuring essentially vertical hydraulic conductivity (K) in the zone between soil surface and the water table are discussed. Seepage meters are suitable for measuring K of bottom material (including impedance of clogged surfaces) and local infiltration rates and gradients in spreading basins. A newly developed permeameter-type device enables relatively rapid field measurement of K and the negative soil-water pressure, whereby K undergoes its first reduction. The method is applicable to surface and subsurface soil layers and data are obtained for sorption as well as for desorption. Field experiences with the double-tube method are summarized and certain desirable design and operational features presented. Relatively deep K measurements can be made by determining infiltration rates and gradients at the bottom of auger holes and wells. Fast-reacting piezometers enabling pressure measurement shortly after insertion were developed for this purpose. A brief discussion illustrates how the K data obtained can be used in analytical, analog, or digital models for predicting total flow systems below spreading basins, including infiltration rates or transmission losses from ephemeral streams.

R202747 67A

Bouwer, Herman

FIELD MEASUREMENT OF SATURATED HYDRAULIC CONDUCTIVITY IN INITIALLY UNSATURATED SOIL

Symp Int Union Geod Geophys-Int Ass Sci Hydrol, Haifa, Israel, pp 243-251, Mar 1967. 9 p, 3 fig, 12 ref

U S Water Conservation Laboratory, Phoenix, Ariz

DESCRIPTORS.. / *hydraulic conductivity/ *field permeability tests/ water table/ infiltration/ seepage/ measuring instruments/ *permeameters/ ephemeral streams/ auger borings/ models/ wells/ analogs/ groundwater flow/ *permeability/ porous materials/ fluid flow/ saturation/ ground water/ pervious soils/ field tests/ piezometers
IDENTIFIERS.. / seepage meters/ *permeability coefficients

R202748 67A FRESH GROUND WATER IN COASTAL AREAS

Information on the hydrogeological conditions of coastal fresh ground waters and their schematic characterization is given. Principles of estimating the development possibilities of coastal fresh ground water (considering salt water encroachment) as applied to concentrated and linear water intakes are presented. Problems of hydrogeological investigations and the sequence of their performance in connection with the exploration and forecasting of fresh ground water resources in coastal areas are discussed.

R202748 67A

Babushkin, V D and Goldberg, V M

HYDROGEOLOGICAL INVESTIGATIONS AND ESTIMATION OF FRESH GROUND WATER RESOURCES IN COASTAL AREAS

Symp Int Union Geod Geophys-Int Ass Sci Hydrol, Haifa, Israel, pp 383-389, Mar 1967. 7 p, 1 ref

All-Union Scientific Research Institute of Hydrogeology and Engineering Geology, Moscow, USSR

DESCRIPTORS.. / *ground water/ *coasts/ *fresh water/ *aquifers/ wells/ salinity intrusion/ field investigations/ groundwater recharge/ salt water barriers/ water yield/ forecasting/ groundwater geology

IDENTIFIERS.. / hydrogeology/ groundwater management

R202749 67A OPTIMAL YIELD OF AN AQUIFER

The criterion of optimal yield should replace the commonly used concepts of safe yield or mining yield. Optimal yield is a criterion based on: (1) physical characteristics of the aquifer, including natural replenishment and its stochastic nature; (2) economic considerations, including the objective of the considered operation; and (3) features of the water resources system of which the aquifer is a component. The proposed approach for treating the problem of aquifer use is based on a mathematical model and determination of the numerical values or functional form of the decision variables by means of the model solution. The mathematical model includes an objective function and constraints; the planning criterion is the maximization of the objective function subject to all constraints involved. The problem of planning ground water use is formulated with this criterion in mind. The proposed approach is introduced through analysis of a simple model of coastal aquifer, including pumping and recharge installation. The problem of the optimal operation of the system and its solution are given.

R202749 67A

Bear, J and Levin, O

THE OPTIMAL YIELD OF AN AQUIFER

Symp Int Union Geod Geophys-Int Ass Sci Hydrol, Haifa, Israel, pp 401-412, Mar 1967. 12 p, 5 fig, 5 ref

Israel Institute of Technology, Haifa

DESCRIPTORS-- / *aquifers/ *ground water/ models/ groundwater recharge/ mathematical analysis/ *underground water storage/ water management/ hydrology/ *optimum use/ optimum development plans/ *water yield/ wells

IDENTIFIERS-- / safe yield/ pumping/ economic evaluation/ mathematical models/ *groundwater management/ stochastic models/ optimization

R202750 67A GROUND WATER BASIN UTILIZATION

California has initiated utilization studies of ground water basins to develop feasible basin operation plans for providing low cost water with no deterioration of natural resources. The methods and findings from the study of the Los Angeles Coastal Plain are presented. New techniques developed for evaluation include a nonlinear mathematical model to simulate dynamic behavior of a ground water basin. Comprehensive geologic and hydrologic studies provided the data, and a general purpose digital computer was used to develop and test the model. The general procedures for setting up the nodal network and model parameters are given. An online digital plot technique is described for providing graphical output to simplify model testing. A verified model of the ground water basin provides reliable results for evaluating physical feasibility and comparing costs of various management plans. The techniques are adaptable to studies in any area of the world.

R202750 67A

Chun, Robert Y D; Weber, Ernest M; Mido, Kiyoshi W

PLANNED UTILIZATION OF GROUND WATER BASINS: STUDIES CONDUCTED IN SOUTHERN CALIFORNIA

Symp Int Union Geod Geophys-Int Ass Sci Hydrol, Haifa, Israel, pp 426-434, Mar 1967. 9 p, 2 fig, 1 ref

California State Department of Water Resources, Sacramento

DESCRIPTORS-- / water development/ *water management/ water utilization/ water supplies/ *ground water/ groundwater flow/ groundwater geology/ groundwater recharge/ *underground water storage/ digital computers/ costs/ aquifers/ hydrology/ feasibility studies/ basins/ model tests/ benefit-cost ratios

IDENTIFIERS-- / mathematical models/ Los Angeles Coastal Plain/ systems engineering/ *groundwater management

DRAINAGE AND GROUND WATER

R202777X67A STORM RUNOFF FOR GROUND WATER RECHARGE
Extensive study is being done in Israel on use of floodwater to supplement the insufficient water supply. Because only 10% of storm runoff can be stored by surface means, artificial recharge into the ground is being studied in laboratory and field investigations. Laboratory work directed toward correlating parameters such as infiltration velocity, pF curve, and volume and size distribution of pores with saturated-state hydraulic conductivity. Field investigations were conducted on subsoil structural changes as well as seepage tests in small ponds and spreading operations. Results indicate that sediment load resulting in soil clogging is the most serious problem in recharging by either spreading or well injection. Recommendations for further investigations are outlined. Has 15 references.

R202777X67A

Berend, J E; Rebhun, M; Kahana, Y

USE OF STORM RUNOFF FOR ARTIFICIAL RECHARGE

Trans Amer Soc Agr Eng, Vol 10, No 5, pp 678-684, 1967. 7 p, 5 fig, 2 tab, 15 ref

Water Planning for Israel, Ltd; Israel Institute for Technology; Water Planning for Israel, Ltd, Tel Aviv

DESCRIPTORS--/*runoff/ *surface runoff/ *groundwater recharge/ storms/ infiltration/ settling basins/ spreading basins/ hydraulic conductivity/ sediments/ sand filters/ bibliographies/ suspended sediments/ turbidity/ flocculation/ permeability/ water quality/ percolation/ injection/ alum/ dune sands/ groundwater geology

IDENTIFIERS--/ clogging/ *storm runoff/ *artificial recharge

ELECTRICAL ENGINEERING

R202710 67A CORONA NOISE ON KUMATORI EHV TEST LINE

Corona noise characteristic studies made on the 500-750-kv test line at Kumatori Research Laboratory, Japan, are reported. Measuring methods for corona noise and automatic recording equipment are described. About 4000 measurements of corona noise made on the test line under clear and rainy weather conditions were statistically treated by computer. Radio noise levels of 500-kv overhead transmission lines with conductor configuration and phase spacing similar to this test line are predicted to be 41 db (standard deviation, 3.5 db) in fair weather and 49 db (standard deviation, 6 db) during rainy weather conditions. Has 15 references.

R202710 67A

Nagasaki, Shoji; Mori, Norihiro; Fukuyama, Katsumi

CORONA NOISE CHARACTERISTICS ON THE KUMATORI TEST TRANSMISSION LINE

Sumitomo Elec Tech Rev, No 10, pp 41-48, Oct 1967. 8 p, 15 fig, 5 tab, 15 ref

DESCRIPTORS--/ *electrical coronas/ instrumentation/ *radio interference/ characteristics/ *extra high voltage/ transmission lines/ attenuation/ bibliographies/ test facilities/ test procedures/ high frequency/ noise/ bundled conductors/ weather/ rainfall/ forecasting/ design

IDENTIFIERS--/ Japan/ foreign research/ test transmission lines/ testing equipment/ *electric discharges/ electric conductors

R202711 67A FIELD RESEARCH ON H-V UNDERGROUND CABLE
To assure safe and reliable operation of the 275-kv aluminum-sheathed oil-filled cable system for long-distance underground transmission, field research on cables and their accessories has been conducted since June 1966 at the Kumatori Research Laboratory, Japan. Mechanical properties of the cable such as thermal expansion and contraction, displacement of a joint box in the manhole, and the strain on aluminum sheath caused by a daily loading cycle were measured automatically; information has been obtained on mechanical behavior of such a cable installation. Electrical properties, namely power factor and electrostatic capacity, were measured on the cable joints. These tests show that the dielectric properties of oils (mineral or synthetic) and insulators composed of oil-impregnated deionized water-washed low-cellulose-density papers are fully stable.

R202711 67A

Hata, Haruo; Matsuura, Kenji; Nishino, Isao, et al

FIELD RESEARCH ON 275 KV ALUMINUM SHEATHED OIL-FILLED CABLE FOR LONG DISTANCE UNDERGROUND TRANSMISSION LINES

Sumitomo Elec Tech Rev, No 10, pp 21-31, Oct 1967. 11 p, 22 fig, 5 tab, 8 ref

DESCRIPTORS-- / transmission lines/ *mechanical properties/ contractions/ thermal expansion/ *electrical properties/ power factors/ field tests/ electrostatics/ dielectrics/ aluminum/ *extra high voltage/ *electric cables

IDENTIFIERS-- / *underground cables/ Japan/ *cable sheaths/ insulating oil/ cable terminations/ *buried cables/ oil-filled cables

R202715X67A SKIN EFFECT

Alternating current distribution in a conductor is not uniform throughout its cross section but mainly flows in a thin layer at the surface, a phenomenon called skin effect. Current distribution for various-shaped conductors and the differences occurring in ferromagnetic and nonferromagnetic metals are discussed. The effect that current frequency and conductivity of metals has on the theory of skin effect is studied in detail. The skin effect in metals that are superconducting is discussed. A simple model of the superconductor is the 2-fluid model in which a fractional part of the electrons is superconducting and the remainder normal. In this model the superconducting electrons are responsible for the screening effect, even at zero frequency, while the normal electrons in the skin layer thus formed are responsible for the adsorption that occurs only at nonzero frequencies. Has 58 references.

R202715X67A

Casimir, H B G and Ubbink, J

THE SKIN EFFECT

Philips Tech Rev, Vol 28, No 9, 10, & 12, pp 271-283, 300-315, 366-381, 1967. 45 p, 40 fig, 8 tab, 58 ref

DESCRIPTORS-- / *alternating currents/ high frequency/ magnetic fields/ *ferromagnetism/ bibliographies/ *electric fields/ electrons/ theory/ *electrical conductance/ *electromagnetism/ magnetic induction/ electric cables/ electrical engineering/ research and development/ electric currents/ transmission (electrical)/ electric wires
IDENTIFIERS-- / superconductors/ *electric conductors/ foreign research/ Netherlands/ *skin effect (electrical)

R202716X68A PILOT WIRE CABLE PROTECTION FOR RELAYING
Pilot wire cables used for high-speed tone and a-c pilot wire relaying are subject to induced voltage transients which can cause false relaying of transmission circuits. Human errors can cause a pilot wire relaying scheme to malfunction, but most troubles are directly related to the neighboring transmission circuit. Years of experience at Gulf States Utilities have led to a practical protective scheme which insures system success. During the last few years a large number of tone-type transfer trip terminals using both underreaching and overreaching relay schemes have been applied to subtransmission systems. The carrier spectrum is crowded, and carrier relaying is used primarily on 138-kv transmission systems. With the introduction of 500 kv and a need for carrier spectrum space, the 138-kv use of carrier is being replaced by microwave relaying. Tone-type relaying schemes are the only salvation where pilot wire relaying schemes cannot be used. The relaying schemes and test procedures are described. Protective measures are listed, and transfer trip tone-type relaying is discussed.

Baumgartner, E A

R202716X68A

TRANSIENT PROTECTION OF PILOT WIRE CABLES IS ESSENTIAL FOR RELIABLE OPERATION

Transmission Distribution, Vol 20, No 1, pp 80-85, Jan 1968. 6 p, 3 fig, 3 ref

Gulf States Utilities Co, Beaumont, Tex

DESCRIPTORS-/- *electric relays/ transmission lines/ electric potential/ transients/ electric power/ electric motors/ *reliability/ economics/ electric currents/ electrical engineering/ electric insulation/ inductance/ electromagnetic shielding/ electrostatics/ electromagnetic properties/ microwaves/ communications/ powerline carriers
IDENTIFIERS-/- *protection (electrical)

R202717X68A SHIELD-WIRE LOCATION AFFECTS PROTECTION

Location of shield wires on transmission lines, and the wind direction of electrical storms affect the degree of protection from flashovers. Studies suggest that winds influencing cloud movement toward a line can blow a leader lightning stroke or propel ionized clouds toward a line and reduce protective effects of the overhead ground wire by increasing its shielding angle to a point where the ground wire is no longer effective. A study of outages caused by electrical storms on 2 adjacent double-circuit transmission lines is presented. The operating record of a 138-kv, double-circuit transmission line using 2 overhead ground wires spaced for a negative shielding was unusually good in an area with an isoceraunic level of 50.

Lindell, C H

R202717X68A

SHIELD-WIRE LOCATION AFFECTS LINE PROTECTION

Transmission Distribution, Vol 20, No 1, pp 68-71, Jan 1968. 4 p, 5 fig

Cincinnati Gas & Electric Co, Ohio

DESCRIPTORS-/- *transmission lines/ design/ *lightning/ thunderstorms/ wind (meteorology)/ extra high voltage/ ionization/ transmission towers/ clouds/ costs/ *shielding/ electric power failures/ electrical engineering/ electrical grounding

IDENTIFIERS-/- *protection (electrical)/ flashover/ lightning protection/ outages/ *overhead ground wire

R202729X68A LOAD-FLOW CALCULATION BY LOSS TECHNIQUES
Loss-minimization techniques applied to load-flow analysis form an effective means of obtaining a desirable voltage solution. In addition, the method offers improvement in convergence, especially important for networks giving rise to ill-conditioned equations. The method described uses the nodal-impedance matrix and minimizes that part of the total real-power losses depending on the generator reactive-power input and transformer tap settings. The reactive-power input and voltages at the generator busbars, together with transformer tap settings, are calculated automatically by the program according to the criterion of minimum loss. In contrast to methods previously employed, the off-nominal turns ratio of the transformers is represented by a superimposed branch current and an injected nodal current; the transformers may be in-phase or phase-shifting. Incorporating the minimization procedures into the iterative process of a general load-flow program is illustrated. A comparison with other methods is given by means of a sample-system study.

R202729X68A

Zollenkopf, K

LOAD-FLOW CALCULATION USING LOSS-MINIMISATION TECHNIQUES

Proc Inst Elec Engs (Engl), Vol 115, No 1, pp 121-127, Jan 1968. 7 p,
5 fig, 3 tab, 10 ref, append

Hamburgische Electricitaets-Werke, Hamburg, W Germany

DESCRIPTORS-/ *electric power/ electric generators/ power transformers/
*electrical networks/ calculations/ alternating currents/ optimum use/
electrical stability/ matrix algebra/ electrical engineering/ electrical
properties/ *losses

IDENTIFIERS-/ *load flow/ foreign research/ West Germany/ *power losses/
optimization/ reactive loads

R202730X68A DISTANCE PROTECTION UNDER FAULTS

The protection coverage afforded by earth- and phase-fault distance relays is evaluated in terms of the range of apparent impedances presented to them for which the protection correctly operates and initiates circuit-breaker tripping. A knowledge is required of the effective polar characteristics of relays and the apparent impedance to which the relays respond for specified system-fault conditions. Owing to the wide variation in both of these in practice, the ordinary static characteristics of relays provide only a limited indication of the discriminative properties of distance relays in different applications; however, a method for comprehensive assessment of the relay characteristics is shown. Mho relay performance is described when the relays are used on 132- and 400-kv circuits, and investigation results are summarized. Studies include response to faults within the protected zone and discrimination against external reverse faults, healthy-phase relay operation, and healthy-circuit relay operation on double-circuit-line constructions. Time response of comparators in impedance measurement is introduced, and an explanation is given of the coverage afforded by this protection, directly related to operating time and discriminative properties of the relays.

R202730X68A

Humpage, W D and Kandil, M S

DISCRIMINATIVE PERFORMANCE OF DISTANCE PROTECTION UNDER FAULT OPERATING CONDITIONS

Proc Inst Elec Engs (Engl), Vol 115, No 1, pp 141-152, Jan 1968. 12 p,
20 fig, 8 tab, 10 ref, append

University of Manchester Institute of Science & Technology, Great Britain

DESCRIPTORS-/ *electric relays/ *faults (electrical)/ polarization/
transmission lines/ extra long distance/ extra high voltage/ remote
control systems/ characteristics/ electric power/ alternating currents/
electrical engineering/ power transformers/ supervisory control (power)

IDENTIFIERS-/ *protection (electrical)/ foreign research/ Great Britain

R202737X68A DIELECTRIC TESTS FOR EHV TRANSFORMERS
Specific proposals for revision of dielectric tests for ehv power transformers are presented. These new transformer-insulation tests are based on operating and transient voltages to which the transformer will be subjected during service and should lead to improved operating reliability. Impulse and switching surge tests are based on the maximum impulse and switching surge voltages allowed by the lightning arrester to reach the transformer. These test voltages are at least 15% above the lightning arrester protective level. Low-frequency tests are disassociated from transient voltage requirements and related to operating voltage only. Low-frequency test voltages are reduced and their duration is increased. Measurements made during the low-frequency test period must demonstrate that the insulating structure is free of corona during the entire test time, giving assurance of ample design and careful manufacturing. Reductions in test voltages will permit improved reliability and some reductions in transformer size and weight. Has 25 references.

Kaufman, Richard B and Meador, Jack R

R202737X68A

DIELECTRIC TESTS FOR EHV TRANSFORMERS

Inst Elec Electron Engs Trans Power App Syst, Vol PAS-87, No 1, pp 135-145, Jan 1968. 11 p, 2 fig, 4 tab, 25 ref, disc

General Electric Co, Pittsfield, Mass

DESCRIPTORS-- / *dielectrics/ extra high voltage/ *power transformers/ *impulse tests (electrical)/ bibliographies/ test procedures/ electric potential/ *electrical coronas/ standards/ radio interference/ *electric insulation/ reliability/ electric power failures/ bushings

IDENTIFIERS-- / *dielectric properties/ switching surges/ *lightning arresters

R202738X68A POWERLINE CARRIER ON BUNDLED CONDUCTORS

A system of powerline carrier communication, using insulated bundle conductors and having an attenuation of about 0.1 db/mi at 100 khz, is described. Merits and disadvantages of this unconventional method are discussed. Push-pull coupling to the conductors of one bundle is shown to exhibit an inherent property of high rejection of substation noise, a feature of particular interest for d-c transmission lines. This system of powerline carrier communication may permit an increase in the number of carrier channels and make carrier operation possible on d-c lines with very long pole spacing, where attenuation of conventional powerline carrier would be prohibitively large. Simplified modal analysis is developed, leading to a practical solution of coupling and transmission problems on 2-, 3-, and 4-conductor bundles. Further experimental investigations must be made to determine the final performance and cost of such an installation.

Perz, Matthias C

R202738X68A

POWER LINE CARRIER ON INSULATED BUNDLE SUBCONDUCTORS OF DC AND AC TRANSMISSION LINES

Inst Elec Electron Engs Trans Power App Syst, Vol PAS-87, No 1, pp 162-173, Jan 1968. 12 p, 8 fig, 2 tab, 14 ref, 3 append, disc

Ontario Hydro-Research, Toronto, Canada

DESCRIPTORS-- / *powerline carriers/ alternating currents/ attenuation/ direct currents/ transmission lines/ power system operations/ faults (electrical)/ *communications/ analysis/ *bundled conductors/ extra high voltage/ electrical coronas/ radio interference/ investigations/ electromagnetic properties/ ice/ frost
IDENTIFIERS-- / protection (electrical)/ Canada/ foreign research/ *carrier-current/ switching surges

R202739X68A POWER SYSTEM PHASE ANGLE MEASUREMENT

Load rejection tests conducted on nuclear steam generators in the Bonneville Power Administration transmission system during 1966 afforded an excellent opportunity to monitor the characteristic response of the Northwest Power System. An extensive instrumentation program was initiated, including measuring the voltage phase angle existing between the ends of a transmission line. A phase-angle measuring device is described which has a response time of one cycle of the signals whose phase angles are being measured. The device has an adjustable full-scale range which allows high-accuracy readings of small phase-angle changes. An output is provided for continuous, fast response recording of phase-angle changes suitable for use on an oscilloscope. Test results using the measuring device are shown.

R202739X68A

Raupach, Richard C and Stemler, Gary E

A FAST RESPONSE INSTRUMENT FOR MEASUREMENT OF POWER SYSTEM PHASE ANGLES

Inst Elec Electron Engs Trans Power App Syst, Vol PAS-87, No 1, pp 187-189, Jan 1968. 3 p, 4 fig, 3 ref

Bonneville Power Administration, Portland, Oreg

DESCRIPTORS-- / *instrumentation/ electric potential/ transmission lines/ characteristics/ disturbances/ electrical stability/ circuits/ electric power/ *phase control/ telemetry systems/ electronic equipment/ solid state physics/ oscilloscopes/ *electrical networks/ integration/ field tests

IDENTIFIERS-- / load rejection/ Bonneville Power Admn/ *load-frequency control/ power system stability

R202740X68A HIGH-ALTITUDE TESTS ON A GUYED V TOWER

High-altitude impulse and switching surge tests were conducted on a guyed V tower at an elevation of 10,540 ft (3220 m). Tower insulation with bonded and unbonded wood crossarms was tested using 10, 16, and 21 5-3/4- by 10-in. insulators. No tests were made in rain or in the presence of fog, dew, or frost, but a few tests were conducted during a light snow and with snow on the insulators and crossarms. Under the worst conditions of bonded crossarms and positive switching surges, 14 insulators were determined to be adequate for 230-kv operation at 10,000-ft elevation with the tower design tested. Results obtained with up to 21 insulators will provide a guide in the selection of insulators and tower design for use at high altitudes and voltages higher than 230 kv.

R202740X68A

Robertson, Lawrence M; Brownlee, Theodore; Jones, Paul K

HIGH-ALTITUDE IMPULSE AND SWITCHING SURGE TESTS ON A GUYED V TOWER

Inst Elec Electron Engs Trans Power App Syst, Vol PAS-87, No 1, pp 290-294, Jan 1968. 5 p, 7 fig, 3 tab, 3 ref, disc

Public Service Co of Colorado, Denver; General Electric Co, Pittsfield, Mass

DESCRIPTORS-- / *guyed towers/ *impulse tests (electrical)/ transmission towers/ test procedures/ weather/ *electric insulation/ *clearances/ investigations/ electric potential/ safety factors/ ionization/ test facilities/ electrical conductance/ transmission (electrical)

IDENTIFIERS-- / flashover/ *switching surges/ *electrical insulators/ polarity/ electric conductors

R202765X68A HARMONIC CURRENTS ON HVDC LINES

The harmonic voltages impressed by converters on both ends of a hv-dc transmission line result in harmonic current flow that can cause telephone interference. A procedure is presented for calculating this harmonic current in a high voltage direct current transmission line. An analysis is made of a bipolar line, determining the maximum current on the line for the worst phase position of the voltages applied at each end of the line. Terminating impedances are included, and the current phase position and location on the line determined for maximum harmonic currents. Equations for this solution and a sample calculation are given.

R202765X68A

Specht, T R

HARMONIC CURRENTS ON HV-DC TRANSMISSION LINES

Inst Elec Electron Engrs Winter Power Meeting, New York, N Y, Pap 68
CP 117-PWR, Jan 28-Feb 2, 1968. 10 p, 4 fig, 1 tab, 4 ref, append

Westinghouse Electric Corp, Sharon, Pa

DESCRIPTORS-/ extra high voltage/ *direct currents/ transmission lines/
electric potential/ electric currents/ radio interference/ *telephones/
*interference/ rectifiers/ filters (electromagnetic)/ analysis/ electric
power/ calculations/ characteristics/ converters (electrical)

IDENTIFIERS-/ *harmonics/ accuracy

R202766X68A IEEE REPORT ON CAPACITANCE SWITCHING

The Interrupter Switch Working Group of the IEEE Switchgear technical committee has recommended revisions of the United States of America Standards Institute (USASI) standards C37.30 and C37.3^{1/2} covering capacitance switching. The proposed guide will aid the proper application of interrupter switches when switching capacitance loads. The 3 general types of capacitor loads which may be switched are static capacitors, cables, and overhead lines. Recommendations for switching capacitor banks are given. However, recommendations applicable to switching cables and overhead lines have not been completed and in the interim manufacturers should be consulted for proper use of their equipment. Proposed additions and revisions to the standards for High Voltage Air Switches are included in this report.

R202766X68A

Baker, C H

REPORT OF WORKING GROUP ON CAPACITANCE SWITCHING WITH INTERRUPTER SWITCHES

Inst Elec Electron Engrs Winter Power Meeting, Pap 68 CP 160-PWR,
New York, N Y, Jan 28-Feb 2, 1968. 28 p, 1 fig, 2 tab, 3 ref

S&C Electric Co, Chicago, Ill

DESCRIPTORS-/ *standards/ *interrupters/ *electric switches/ electric
power/ electrical engineering/ capacitors/ electric cables/ electrical
equipment/ transmission lines/ manufacturing/ electric currents/
electric potential/ transients

IDENTIFIERS-/ *recommendations/ application techniques/ performance/
overvoltage/ air switches

R202773X67A TESTS FOR DAMAGING CORONA ON TRANSFORMERS
A proposed standard procedure for corona tests on oil-immersed transformers is presented, and some of the problems in developing such test procedures are discussed. The proposed test method is based on radio influence voltage (RIV) measurements utilizing a radio noise meter coupled to the test winding through a coupling capacitor or the capacitance tap of a bushing. A special tuned circuit is used with the bushing capacitance tap method to minimize attenuation of RIV due to the ratio of bushing capacitances and thus increase the sensitivity of the method. Several problems of corona testing requiring further investigation are discussed.

R202773X67A

Institute Electric Electronics Engineers Committee Report

TESTS FOR DAMAGING CORONA ON OIL-INSULATED POWER TRANSFORMERS

Inst Elec Electron Engs Trans Power App Syst, Vol PAS-86, No 12, pp 1592-1595, Dec 1967. 4 p, 1 fig, 11 ref, disc

DESCRIPTORS./ *electrical coronas/ *power transformers/ standards/ test procedures/ radio interference/ dielectrics/ sensitivity/ electric insulation/ bushings/ electric currents/ electric potential/ electric power/ attenuation/ instrumentation/ measurement/ damages

IDENTIFIERS.- / *electric discharges/ electrical insulation tests/ testing

R202774X67A PORTABLE SAFETY GROUNDING EQUIPMENT TESTS
The basic principle of safety grounding for the protection of workmen must be complemented by adequate grounding devices. Because of the great importance of these devices their adequacy should be proved by tests whenever (1) their design is changed although the change is an improvement; (2) system condition changes have accumulated beyond previously established limits; and (3) the slightest doubt about the reliability of a particular design has arisen. Test setups were designed to simulate field conditions as closely as possible and the tests made to cover the most severe service requirements. Resistance of test specimens was measured before each test and oscillograms, photographs, and motion pictures were taken. When the test specimen did not fail, although the test circuit time setting was well beyond the expected duty, resistance measurements were made after the test. Representative test results are given.

R202774X67A

Falck, Knute J and Butterfield, Hollis S

PORTABLE SAFETY GROUNDING EQUIPMENT TESTS

Inst Elec Electron Engs Trans Power App Syst, Vol PAS-86, No 12, pp 1579-1582, Dec 1967. 4 p, 5 fig, 1 tab, 1 ref, disc

Philadelphia Electric Co, Pa

DESCRIPTORS./ *safety/ *power O&M/ *electrical grounding/ electrical equipment/ personnel/ portable/ test procedures/ transmission (electrical)/ substations (electrical)/ oscilloscopes/ photographs/ electrical resistivity/ measurement/ switchyards (electrical)

IDENTIFIERS./ switchgear/ electric utilities/ electrical design/ *safety equipment/ electric conductors

R202775X67A REGULATION OF INTERCONNECTED AREAS
Some factors related to control of generation and power flow on interconnected systems are analyzed. The paper examines criteria for determining effectiveness of regulation within an individual control area. System control error is defined and the relationship to system frequency deviation and to system stored energy is developed. Inadvertent interchange is explored and the relationship to system time error for an area that regulates to zero control error is developed. Conditions are defined under which the algebraic summation of inadvertent interchange around the interconnection would be zero, and operating conditions when this would not be true are identified. The technique used by some control areas of correcting for inadvertent interchange by a unilateral change of net interchange schedule is evaluated. The adverse effect that such unilateral action can have on the inadvertent accounts of other areas is discussed. How the system load-frequency characteristic supplements stored energy changes in accommodating load changes too small to induce governor action is demonstrated. A technique is suggested for coordinated system-wide correction of inadvertent interchange accumulations.

R202775X67A

Cohn, Nathan

CONSIDERATIONS IN THE REGULATION OF INTERCONNECTED AREAS

Inst Elec Electron Engs Trans Power App Syst, Vol PAS-86, No 12,
pp 1527-1538, Dec 1967. 12 p, 8 fig, 1 tab, 1^h ref, disc

Leeds & Northrup Co, Philadelphia, Pa

DESCRIPTORS-/- electric power/ control systems/ *power system operations/
electric power production/ electric power demand/ economics/ errors/
automatic control/ frequency/ characteristics/ speed regulators/
operations/ transmission (electrical)/ coordination/ scheduling/
*electrical networks
IDENTIFIERS-/- *interconnected systems/ interties/ *power dispatching/
tie lines/ load-frequency control/ system stability (elect)

FOUNDATIONS

R202722X67A BASE FRICTION FOR FOOTINGS

The value of the angle of base friction between concrete and gravel under high normal stresses was investigated. Results were used to design abutments for the Rhine Bridge located near Emmerich and completed in 1965. The tests consisted of model blocks of concrete with a rough base being moved horizontally above and below water level. Great variations of friction coefficients were indicated when the tests were evaluated by the usual method; however, by including the energy attributed to vertical movement of the model blocks during shearing, all test results were reduced to a true angle of base friction. Direct shear tests were carried out with the same test device; considering the energy correction, they yielded a true angle of internal friction equal to the true angle of base friction. A series of triaxial tests with 10-cm-dia samples, in which energy correction was determined from the volume change during shear, leads to approximately the same result.
Has 20 references.

R202722X67A

Schultze, E and Horn, A

THE BASE FRICTION FOR HORIZONTALLY LOADED FOOTINGS IN SAND AND GRAVEL

Geotechnique, Vol 17, No 4, pp 329-347, Dec 1967. 21 p, 17 fig, 1 tab,
20 ref

Technische Hochschule, Aachen, W Germany; Rhein-Ruhr-Ingenieurgesellschaft, Dortmund, W Germany
DESCRIPTORS-/- *friction tests/ *friction/ *footings/ internal friction/
*granular materials/ bibliographies/ sands/ gravels/ normal stress/ soil mechanics/ horizontal loads/ roughness/ coefficients/ direct shear/
laboratory tests/ field tests/ triaxial shear/ energy/ *foundations
IDENTIFIERS-/- Germany/ foreign research/ volume change

R202759 67A BEARING CAPACITY OF FOUNDATIONS

Extensions to the Terzaghi and Meyerhof formula for the bearing capacity of shallow foundations are presented. These extensions were made to clarify use of these theories for problems wherein water table and pore pressure conditions affect the bearing capacity of foundations in saturated and partially saturated soils. Different methods for determining the factors of safety for bearing capacity calculations are given, and recommendations are made for use by design engineers. A computer program that will determine bearing capacity is described briefly. The program is based on input information relating to column loads and considers automatically the weight of footings. A flow chart of the program is given. Preliminary test results are shown to confirm the proposed extensions to the established theories.

R202759 67A

Sparks, A D Walsh

FACTORS OF SAFETY AND OTHER ASPECTS RELATING TO THE BEARING CAPACITY OF FOUNDATIONS

Proc Soil Mech Found Eng 4th Reg Conf Africa, Cape Town, S Africa, Vol 1, pp 271-276, Dec 1967. 6 p, 5 fig, 1 tab, 8 ref

University of Cape Town, Rondebosch, South Africa

DESCRIPTORS.. / *foundation bearing tests/ *foundations/ *bearing capacities/ *safety factors/ design criteria/ flow diagrams/ water table/ saturation/ submergence/ pore pressures/ shear stress/ pore water pressures/ cohesion/ internal friction/ capillarity/ footings/ computer programming

IDENTIFIERS.. / foreign research/ South Africa

R202772X67A DYNAMIC TESTING OF FOUNDATION PILES

Dynamic tests were performed on concrete piles cast in situ to determine quality and load-bearing capacity. The first tests conducted were on steel reinforced piles, 9- to 13-m long, cast in boreholes of 40-cm diameter in a deep layer of thick homogeneous clay. The test piles were vibrated by horizontal blows at the top and vibrations of the upper ends were recorded by a vibrograph. In a weakened pile amplitude is much greater and frequency much lower than in an intact one. Tests were also conducted on end-bearing piles. For these tests, vibration was induced by a vertical blow. The test was applied also to slanting piles. Application and reliability of the test method are discussed. The method is only comparative and yields a relative estimate of quality of piles whose absolute load-bearing capacity must be established by a static load test. The tests do produce, at a relatively low cost, instant information about any serious defects in the piles.

R202772X67A

Dvorak, Arnost

DYNAMIC TESTING OF FOUNDATION PILES

Tech Digest, Vol IX, No 11, pp 796-803, Nov 1967. 8 p, 16 fig, 4 ref

Geological and Hydrological Survey, Prague, Czechoslovakia

DESCRIPTORS.. / *piles/ pile bearing capacities/ friction piles/ dynamics/ *pile foundations/ *foundations/ boreholes/ reinforced concrete/ loads/ vibrations/ static tests/ clays/ soils/ quality control/ cast-in-place structures/ bearing piles

IDENTIFIERS.. / in situ tests/ concrete piles/ dynamic loads/ foreign research/ *dynamic tests/ Czechoslovakia/ cast-in-place piles

R202713 67A RADIOISOTOPES EVALUATE FLOW--A REVIEW

In studies of fluid flow radioactive tracers are employed: (1) in experiments designed to provide data for fundamental flow-theory formulation; (2) for measuring flow parameters under well-defined conditions of flow--velocity, volumetric flow rate, and dispersion in flow; (3) for general examination of the characteristics of a flow system with respect to flow patterns and flow paths; (4) for measuring the dilution caused by the dispersion of dissolved or suspended matter; and (5) for the evaluation of process and process-equipment performance by arranging tracer tests which provide residence-time distributions, information on mixing properties, channeling, recirculation, unintended connections, and leakage. Principles of the various methods and practical procedures are discussed. Comparisons with alternative techniques are made, and reported figures on attainable precision and accuracy are cited. Theoretical aspects of the significance and evaluation of tracer investigations of material turnover are discussed, with particular reference to concepts and models used in analyzing residence-time distributions. An attempt is made to discern general trends of development in radiotracer applications, such as use of the obtained information for process control purposes. Lists 192 references.

R202713 67A

Ljunggren, K

A REVIEW OF THE USE OF RADIOISOTOPE TRACERS FOR EVALUATING PARAMETERS TO THE FLOW OF MATERIAL IN PLANT AND NATURAL SYSTEMS

Isotop Radiat Technol, Vol 5, No 1, pp 3-24, Fall 1967. 22 p, 5 fig, 192 ref

Isotope Techniques Laboratory, Stockholm, Sweden

DESCRIPTORS--/ *radioactive isotopes/ *tracers/ flow/ *fluid flow/ oils/ bibliographies/ discharge measurement/ velocity/ solids/ transportation/ groundwater flow/ dispersion/ reviews/ streamflow/ pipelines/ sediments/ sediment transport/ measuring instruments/ radiation measurement/ water measurement/ hydraulics/ hydrology
IDENTIFIERS--/ dosimeters/ radiation measuring equip

R202779 67A TURBULENCE AND DIFFUSION

This paper is an invited special lecture to the 12th IAHR Congress. The problems of turbulent flow and dispersion are reviewed with emphasis on hydraulic engineering. The mean conditions of shear flow and boundary resistance for both boundary layer flow and conduit flow are presented. A summary is given on turbulence measurement techniques and the agreement of airflow with water flow determinations of the distribution of turbulence intensity. The presence of sediment suspensions and other admixtures is shown to modify the turbulence generated by clear fluid flow. Diffusion due to turbulence and velocity gradients is discussed with regard to the dispersion of neutrally buoyant substances in laboratory and natural channels. Density variations are shown to be an effective dispersion mechanism in estuaries. Finally, unresolved hydraulic engineering research problems in turbulence and dispersion are reviewed. Has 45 references.

R202779 67A

Ippen, Arthur T

TURBULENCE AND DIFFUSION IN HYDRAULIC ENGINEERING

Proc 12th Congr Int Ass Hydraul Res, Ft Collins, Colo, Vol 5, pp 152-189, Sept 1967. 38 p, 13 fig, 2 tab, 45 ref

Massachusetts Institute of Technology, Cambridge

DESCRIPTORS--/ hydrodynamics/ hydraulic engineering/ *turbulence/ fluid flow/ *turbulent flow/ *diffusion/ dispersion/ suspended sediments/ boundary layer/ boundary shear/ channels/ *open channel flow/ fluid mechanics/ streamflow/ hydraulic models/ model tests/ bibliographies/ measuring instruments/ estuaries/ reviews/ hydraulics
IDENTIFIERS--/ shear distribution/ flow characteristics/ *diffusion coefficient

Approximately 70% of the precipitation in the United States is returned to the atmosphere through evapotranspiration. To obtain a procedure for estimating watershed evapotranspiration, a statistical model was derived for permanent grass lysimeter evapotranspiration using lake evaporation, soil moisture, and precipitation as independent variables. Measured annual lysimeter evapotranspiration was substantially greater than evapotranspiration derived from water budget estimates on small watersheds. Differences in the lysimeter evapotranspiration rate for permanent grass and grain crops were greatest at grain planting time when the ground was bare. Lysimeter evapotranspiration fell to about one-half of normal when hay was cut and recovered to normal in about 1 month.

Mustonen, Seppo E and McGuinness, J L

R202782X67A

LYSIMETER AND WATERSHED EVAPOTRANSPIRATION

Water Resources Res, Vol 3, No 4, pp 989-996, 4th Quart 1967. 8 p, 2 fig, 3 tab, 12 ref

Board of Agriculture, Helsinki, Finland; Agricultural Research Service, Coshocton, Ohio

DESCRIPTORS- / *lysimeters/ *watersheds/ *evapotranspiration/ crops/ evaporation/ snow/ solar radiation/ soil moisture/ hydrology/ models/ atmospheric precipitation/ statistics

IDENTIFIERS- / regression analysis/ potential evapotransp/ forests/ hay/ statistical methods/ multiple regression/ hydrologic budget

R202731X67A HEAT BUDGET STUDIES ON THE MADISON RIVER

A study was made to measure the rate of heat loss from the Madison River in Yellowstone National Park in Wyoming to determine effects of radiation, evaporation, and sensible heat exchange on the rate of temperature change of the river. The Madison, receiving heated water from the Firehole and Gibbon Rivers, was considered to be a model river for thermal pollution investigations. The analytical heat budget of a reach of the river was determined and net radiation and heat change in the river were measured. The difference between these 2 measurements was apportioned into evaporation and sensible heat flux by the use of Bowen's ratio. An equation based on net radiation, air and water temperatures, and air and water vapor pressures is given for predicting downstream cooling of rivers.

Wright, John C and Horrall, Ross M

R202731X67A

HEAT BUDGET STUDIES ON THE MADISON RIVER, YELLOWSTONE NATIONAL PARK

Limnol Oceanogr, Vol 12, No 4, pp 578-583, Oct 1967. 6 p, 4 fig, 3 tab, 7 ref

Montana State University, Bozeman

DESCRIPTORS- / *heat transfer/ thermal radiation/ *temperature/ *heat/ evaporation/ air temperature/ water vapors/ *rivers/ *streams/ water/ diurnal variations/ forecasting/ water surface/ vapor pressures/ wind (meteorology)/ cooling/ reaches (distance)/ water pollution/ hydrology/ limnology

IDENTIFIERS- / *heat budget/ *thermal pollution/ *water temperature/ Bowens ratio/ Madison River, Wyo/ Rhodamine B/ albedo/ fluorometers

IRRIGATION

R202764X67A GATES FOR AUTOMATIC SURFACE IRRIGATION

Laboratory developments are described of a system for applying water to furrows, border strips or level basins by means of remotely controlled and hydraulically operated field gates in lined or unlined distribution ditches. The system has direct application where water is diverted from a field supply ditch to a level distribution ditch or so-called level-level ditch in which tubes or spiles are installed for furrow irrigation. Such ditches are usually about 12 ft wide, several hundred feet long, and level crosswise and lengthwise. The system has 2 separate control functions. One control utilizes stilling wells, bleeder valves, and a 4-way hydraulic valve to regulate slide or swing gates designed for fail-safe reasons to maintain a constant depth of water either upstream or downstream from the gate in question. The other control consists of a feature that overrides the above hydraulic system to close the gates to the lateral distribution ditch when sufficient water has been applied. Components of the system and their arrangement in the system are described.

R202764X67A

Haise, H R and Whitney, P L

HYDRAULICALLY CONTROLLED GATES FOR AUTOMATIC SURFACE IRRIGATION

Trans Amer Soc Agr Engs, Vol 10, No 5, pp 639-644, 1967. 5 p, 6 fig
4 ref

U S Department of Agriculture, Ft Collins, Colo

DESCRIPTORS-/- *automatic control/ automation/ irrigation systems/ slide gates/ irrigation/ *surface irrigation/ *hydraulic gates and valves/ sensors/ pressure sensors/ stilling wells/ ditches/ canals/ laterals/ turnouts/ control structures/ irrigation canals

IDENTIFIERS-/- tubes/ hydraulic valves

MATERIALS ENGINEERING

R202719X68A MATERIALS FOR DOMESTIC WATER PIPE SYSTEMS

The properties and corrosion resistance of materials used in domestic water pipe systems are discussed. Materials include cast iron, ductile cast iron, steel, asbestos cement, plastic, copper, and prestressed concrete cylinder pipe. No single pipe material is perfectly suited to every environment or water supply, and the designer must evaluate all available materials. Recognizing the problems of evaluating materials, the California Section of the American Water Works Association established a Materials Performance Committee in 1965 to develop information on the use and performance of pipe materials. A questionnaire was sent to each member of the California Section. A summary of the replies is given with a more detailed evaluation of cast iron and asbestos cement pipe.

R202719X68A

Wilson, Harold E

PERFORMANCE OF CONSTRUCTION MATERIALS FOR DOMESTIC WATER PIPING SYSTEMS

Mater Protect, Vol 7, No 1, pp 24-28, Jan 1968. 5 p, 3 tab, 10 ref

Long Beach Water Department, Calif

DESCRIPTORS-/- *water pipes/ water supply systems/ *materials/ cast iron/ steel pipes/ asbestos cement/ pipes/ plastics/ plastic tubing/ copper tubing/ epoxies/ corrosion/ linings/ mortars/ corrosion control/ joints/ protective coatings/ polyethylenes/ design criteria/ *municipal water

IDENTIFIERS-/- ductile cast iron/ fiberglass plastic pipes/ product evaluation/ underground corrosion/ polyvinyl chloride

MATERIALS ENGINEERING

R202725 67A CORROSION OF LOW-ALLOY STEELS IN BRIDGES
The New Jersey State Department of Transportation is conducting a study on the performance of unpainted, low-alloy steel bridges. Sufficient data are available in published corrosion tests to permit a reasonable estimate of the amount of corrosion that will occur to unstressed sample panels of many low-alloy steels, freely exposed to the atmosphere under various conditions and at numerous locations. These estimates can be made by comparing the chemical composition of a given steel with steels having a similar percentage of the major corrosion-reducing alloying elements; comparisons must be made for similar environments and test conditions. A tentative empirical method is proposed for predicting the depth of corrosion penetration of bridge members. This method assumes a linear long-term corrosion rate and includes exposure, pitting, and safety factors. Reduction in cross sectional properties of several structural members is discussed. The possible effects of loads on corrosion and corrosion on static and fatigue load resistance are discussed; other factors of relevance to the use of unpainted bridges are listed. A proposed test program for an experimental New Jersey bridge is outlined. Gives 30 references.

R202725 67A
Highway Research Record Committee on Metals in Highway Structures

AN ANALYSIS OF ATMOSPHERIC CORROSION TESTS ON LOW-ALLOY STEELS--
APPLICABILITY OF TEST RESULTS TO HIGHWAY BRIDGES

Highway Res Rec, No 204, pp 22-45, 1967. 24 p, 2 fig, 3 tab, 30 ref

State of New Jersey Department of Transportation, Trenton

DESCRIPTORS./ *materials testing/ *corrosion/ *highway bridges/ metals/
alloys/ *steel/ *bridges/ pitting/ scale/ fatigue (mechanics)/ safety
factors/ structural steel/ structural members/ specifications/ exposure/
losses/ test procedures/ bibliographies

IDENTIFIERS./ *materials engineering/ corrosion resistant alloys/ low
alloy steels/ corrosion resistance/ corrosion environments/ New Jersey

R202714X68A THE TREND IN SIMULATION

Simulation is a powerful technique that has been used in the past and will be used in the future to solve important problems. A perfectly valid goal of simulation may be organizing our thinking and knowledge of a problem to permit application of other techniques. Simulation model builders frequently discover that they can predict the results of runs using their models with relatively simple analytical procedures. Consequently, simulation analysts should study optimizing techniques thoroughly to avoid attempting simulation of analytically solvable problems and direct their thinking toward the kinds of solutions which may be most useful and productive. Simulation models should not attempt too much in one leap; massive breakthroughs are likely to produce results which are unverifiable. The author discusses computer modeling of real world processes, a comparison of simulation and laboratory experimentation, advantages of simulation, modeling problems and simulation, validity, and model complexity. Simulation is an extremely valuable tool when used properly to attack problems amenable to simulation; however, it is a wasteful and inappropriate tool when other techniques are available.

MATHEMATICS

Cremeans, John E

R202714X68A

THE TREND IN SIMULATION

Computers Automation, Vol 17, No 1, pp 44-48, Jan 1968. 5 p, 4 fig,
5 ref

Research Analysis Corp, McLean, Va

DESCRIPTORS./ *simulation/ *mathematical analysis/ *synthesis/ feedback/
operations research/ *systems analysis/ computers/ feasibility studies/
experimental data/ data processing systems/ statistical analysis/
queueing theory/ probability/ solutions/ computer programming

IDENTIFIERS./ *problem solving/ *stochastic models/ validity/ *systems
engineering/ heuristic methods/ optimization/ variables

MATHEMATICS

R202778X68A PROGRAMMING THEORY AND EDUCATION

A majority of programmers receive their first exposure to programming in a university. The nature of this education is a function of 2 factors: (1) the lack of communication between industry and the university relative to educational requirements of computer professionals, and (2) the university attitude toward programming and programmer's duties as detailed, complex, routine clerical tasks. Programming should be divided into 2 parts: the theory of programs and the theory of programming. A theory of programs should define a program, list its essential elements and interrelationships, and give its characteristic modes of behavior. Similarly, a theory of programming should describe the phenomena, explain the programming process, define the characteristic behavior of the programmer, and identify the influence of programming practice on program cost and quality. The theory emerging from industry is tentative and incomplete. The programming profession vitally needs the theoretical contributions of the university in mathematical optimization, structure of programs, compiler design, and psychology of programming. Therefore, industry and the university must resolve the discrepancies among needs, practice, and education.

R202778X68A

Constantine, Larry L

THE PROGRAMMING PROFESSION, PROGRAMMING THEORY, AND PROGRAMMING EDUCATION

Computers & Automation, Vol 17, No 2, pp 14-19, Feb 1968. 6 p, 5 fig
1 tab, 9 ref

Information & Systems Institute, Inc, Cambridge, Mass

DESCRIPTORS./ *computer programming/ theory/ professional personnel/
data processing systems/ systems analysis/ *education/ training/ design/
analysis/ preparation/ installation/ maintenance/ instruction/
responsibilities/ universities/ industries

IDENTIFIERS./ systems engineering/ problem solving/ obsolescence

METEOROLOGY AND ATMOSPHERIC WATER RESOURCES

R202756X67A AUGMENTING WATER SUPPLY BY CLOUD SEEDING

The promising potential for increasing winter precipitation over mountains of the Upper Colorado River Basin is presented in broad perspective. The resulting augmented spring runoff, regulated by existing reservoirs, can provide additional water to meet growing demands for the region where present water supplies are becoming critically short. Increasing the November through April precipitation by 15% over 14,200 sq mi of target areas generally located at elevations above 9500 ft will yield an average additional runoff of 1,870,000 acre-ft annually. This practical capability to enhance the winter snowfall should be developed by the mid-1970's through the \$25 million applied research field program outlined in the paper. Exclusive of initial research costs, regular production costs by weather modification are estimated at \$1.00 to \$1.50 an acre-ft for the new water. Average additional benefits are estimated to be \$20 to \$25 million annually for a highly favorable benefit-cost ratio of about 10 to 1. Has 19 references.

R202756X67A

Hurley, Patrick A

AUGMENTING UPPER COLORADO RIVER BASIN WATER SUPPLY BY WEATHER MODIFICATION

Amer Soc Civil Engs Annu Nat Meeting Water Resources Eng, New York,
N Y, Pap, Oct 1967. 36 p, 7 fig, 2 tab, 19 ref

Bureau of Reclamation, Denver, Colo

DESCRIPTORS./ *weather modification/ *cloud seeding/ meteorology/ snow/
water costs/ watersheds/ *artificial precipitation/ feasibility
studies/ atmospheric precipitation/ silver iodides/ runoff/ research
and development/ benefit-cost ratios/ costs/ nucleation/ bibliographies

IDENTIFIERS./ *Upper Colorado River Basin/ orographic precipitation/
*induced precipitation/ flow augmentation/ atmospheric research

METEOROLOGY
AND ATMOSPHERIC
WATER RESOURCES

R202781X67A OPTIMUM DENSITY OF RAINFALL

Techniques of harmonic analysis and concepts of distributed linear systems are used to study the sensitivity of peak catchment discharge to the characteristic spatial variability of convective and cyclonic storm rainfall. Application of the sampling theorem leads to quantitative general relations for optimum rainfall network density for flood forecasting purposes. Specification of network density for the study of long-term, catchment-average rainfall is accomplished by considering the long-term point rainfall as a homogeneous random variable to be sampled spatially. Incorporation of catchment dynamics into the design of flood forecasting networks reduces the number of gages needed when compared with that obtained solely through consideration of precipitation variability. In many studies little advantage is gained by utilizing more than 2 properly located stations for the determination of long-term areal mean rainfall.

R202781X67A

Eagleson, P S

OPTIMUM DENSITY OF RAINFALL NETWORKS

Water Resources Res, Vol 3, No 4, pp 1021-1033, 4th Quart 1967. 13 p, 10 fig, 1 tab, 12 ref

Massachusetts Institute of Technology, Cambridge

DESCRIPTORS-/ *rainfall/ *atmospheric precipitation/ *density/ unit hydrographs/ *networks/ statistical analysis/ watersheds/ discharges/ flood forecasting/ rainfall intensity/ storms/ meteorology/ linear systems/ rain gages/ hydrometeorological station/ hydrology

IDENTIFIERS-/ catchments/ rainfall-runoff relation/ harmonics

R202712X68A EFFECT OF NEW RESERVOIR ON LAND PRICE

A statistical analysis of sales records in the Pearl River Reservoir area in Mississippi shows that a sharp increase in market sales price occurred after the official announcement was made of the location and boundaries of the proposed reservoir site. To conduct the research necessary to appraise the effect of the reservoir on surrounding land prices, recorded sales data of land surrounding the reservoir and a control area similar except for the reservoir, were analyzed. The period from 1950 to 1959, when the official announcement was made, was selected to establish a normal trend of sale price per acre in the reservoir area. In the control area, the normal trend of sale price per acre was established from 1950 to 1963. Magnitude of the speculative influence of the reservoir is shown by comparison of actual sale prices of the same parcel of land from 1954 to 1963. The median price trend and resulting differences or percentage of price per acre increase before and after 1959 are charted to show the speculative influence resulting from the reservoir construction.

PROJECT PLANNING

R202712X68A

Mann, W Merle and Mann, Jack K

ANALYSIS OF THE INFLUENCE OF THE PEARL RIVER RESERVOIR ON LAND PRICES IN THE AREA

Appraisal J, Vol 36, No 1, pp 43-52, Jan 1968. 10 p, 6 fig, 1 tab, 2 ref

Wortman and Mann, Inc, Jackson, Miss

DESCRIPTORS-/ *real property/ *land appraisal/ *reservoirs/ economics/ *appraisals/ values/ statistical analysis/ compensation/ urban areas

IDENTIFIERS-/ effect/ reservoir land value form/ farms/ *prices/ *Pearl River Reservoir, Miss

PROJECT PLANNING

R202727X68A CALIFORNIA'S YUBA RIVER DEVELOPMENT
The Yuba River Development, California, is a multiple-purpose project; its primary functions are conservation and regulation of water for downstream irrigation and municipal use, flood control, hydroelectric power generation, regulation and release of streamflow for maintenance and enhancement of fishlife, and recreation. The 635-ft-high New Bullards Bar Dam, a variable-thickness, double-curvature, monolithic concrete arch structure, is the key unit in the project. Two new powerplants will generate approximately 330 mw of electrical power. River basin hydrology, geology, plan of development, recreational facilities, fish protection and enhancement, and project operation are discussed. Estimated costs for the project and contractors for major permanent equipment are listed.

R202727X68A

Sarkaria, Gurmukh S

CALIFORNIA'S YUBA RIVER DEVELOPMENT

Water Power, Vol 20, No 1, pp 5-16, Jan 1968. 12 p, 12 fig, 3 tab

International Engineering Co Inc, San Francisco, Calif

DESCRIPTORS-/ project planning/ *multiple purpose projects/ *arch dams/ concrete dams/ hydroelectric powerplants/ reservoirs/ recreation/ fish/ flood control/ hydrology/ geology/ design/ construction/ electric power production/ Pelton turbines/ penstocks/ multiple purpose reservoirs/ costs/ contracting/ recreational facilities

IDENTIFIERS-/ *New Bullards Bar Dam, Calif/ *double-curvature arch dams/ Yuba River Basin, Calif/ California/ New Colgate Pwrplt, Calif

ROCK MECHANICS

R202736 67A STRUCTURAL ANALYSIS OF ROCK

The finite element method of structural analysis gives designers a powerful tool to study rock as an in situ building material. With this means of structural analysis, design of rock structures can be resolved into the familiar pattern applied to any structure, but somewhat different procedures and parameters are involved. The method includes the following steps: (1) isolate an appropriate geostructural block containing the opening or excavation from the rock mass for structural analysis; (2) determine the geology of the geostructural block; (3) determine forces acting upon and within the geostructural block; (4) determine mechanical properties of rock; (5) determine stress distribution within the geostructural unit; (6) determine if failure conditions exist; and (7) if collapse conditions exist, determine structural support required to stabilize openings. Each of the steps is discussed and 2 examples (an underground opening and a cut slope) of structural analysis of rock using this method are given.

R202736 67A

Dodd, Jerry S

STRUCTURAL ANALYSIS OF ROCK USING A FINITE ELEMENT METHOD

Intermountain Mineral 3rd Annu Conf, Vail, Colo, Pap, Aug 1967.
53 p, 28 fig, 6 ref

Bureau of Reclamation, Denver, Colo

DESCRIPTORS-/ *rock mechanics/ *structural analysis/ rock excavation/ safety factors/ *stress distribution/ mathematical analysis/ geology/ numerical method/ elastic theory/ shear strength/ structural engineering/ Mohr envelope/ shear stress/ cut slopes/ laboratory equipment/ design/ design tools/ earthquakes/ models/ *rocks
IDENTIFIERS-/ *finite element method/ in situ rock/ rock joints/ rock pressures/ matrix methods (structural)/ *underground openings

R202726X67A REMOVAL OF MICROORGANISMS FROM WATER

Control and removal of microorganisms from water is an accepted part of the water treatment process to make water aesthetically acceptable and safe for drinking. The presence of bacteria is not the only biological problem in water purification. Other organisms such as viruses, fungi, crustacea, and nematodes are resistant to normal doses of disinfectant and present problems in removal. The paper reviews waterborne diseases, the microorganisms involved, and methods of removal. A review of removal processes includes a discussion of colloids, coagulation, flocculation, adsorption, filtration, and sedimentation. Helminths, cysts, and larger bacteria can be removed by simple sedimentation. The smaller bacteria and viruses can be removed directly by ion exchange or absorption processes, or indirectly by coagulation and flocculation. Coagulation and flocculation are undoubtedly of primary importance; however, very little data are available to determine the significance of these processes. Adsorption is clearly an important process with various degrees of influence on the different unit operations. Adsorption may well be the prime removal process, especially for minute virus particles. Has 116 references.

R202726X67A

Van Duuren, F A

REMOVAL OF MICROORGANISMS FROM WATER

Water Water Eng, Vol 71, No 858, 859, 860, & 861, pp 321-325, 360-363, 414-417, & 454-460, Aug, Sept, Oct & Nov 1967. 20 p, 8 fig, 5 tab, 116 ref

University College, London, Great Britain

DESCRIPTORS-/ *microorganisms/ bacteria/ viruses/ collecting method/ colloids/ adsorption/ sedimentation/ bibliographies/ water analysis/ water filters/ water quality/ *water treatment/ public health/ municipal water/ *sanitary engineering/ sewage treatment/ diseases/ flocculation/ chlorination/ water supplies
IDENTIFIERS-/ double layer/ coagulation/ *separation/ coliforms

R202732X67A ZOOPLANKTON IN OZARK RESERVOIRS

The zooplankton populations of the newly completed Beaver Reservoir before full impoundment are compared with those of the 14-yr-old Bull Shoals Reservoir. Both reservoirs are on the White River in the Arkansas-Missouri Ozarks. Rotifer densities were determined at stations representing lower, middle, and upper main stream areas of each reservoir; samples were pumped from 6-m-depth intervals. Planktonic entomostacan and chaoborus populations were determined from tow net samples. One of the major differences in zooplankton populations is manifested in seasonal pulses of abundance in the new reservoir; the old reservoir shows a unimodal curve and the new reservoir a bimodal curve. Significant seasonal differences between the reservoirs occurred in densities, species composition of cladoceran communities, and horizontal distribution. Mean annual standing crops of entomostracans and rotifers were similar in the 2 impoundments. Comparison of mean annual standing crops does not indicate abnormally high zooplankton production in the new reservoir during stages of filling. Any difference in basic productivity is not reflected in the mean annual standing crop; however, seasonal production differences may influence fish production in the new reservoir. Has 18 references.

R202732X67A

Applegate, Richard L and Mullan, James W

ZOOPLANKTON STANDING CROPS IN A NEW AND AN OLD OZARK RESERVOIR

Limnol Oceanogr, Vol 12, No 4, pp 592-599, Oct 1967. 8 p, 4 fig, 5 tab, 18 ref

Bureau of Sport Fisheries and Wildlife, Fayetteville, Ark

DESCRIPTORS-/ fresh water/ *limnology/ *reservoirs/ bibliographies/ fish and wildlife/ *aquatic life/ *fish/ *plankton/ microorganisms/ sampling/ water quality/ water analysis/ environment/ animals

IDENTIFIERS-/ Bull Shoals Reservoir, Ark/ Beaver Reservoir, Ark/ aquatic populations/ *zooplankton/ rotifers/ standing crop/ reservoir fisheries

SANITARY
ENGINEERING

R202758 67A LAKE MEAD WATER QUALITY

This report presents Lake Mead water quality data obtained from 1964 to 1966. The effect of filling Lake Powell on the water quality of Lake Mead is evaluated. General limnological principles and the present limnology of Lake Mead are discussed. Lake Mead has a warm monomictic annual temperature cycle characterized by spring overturn, summer stratification, and continuous circulation throughout the winter; temperatures never fall below 39 deg F (4 deg C). During stratification, lower dissolved oxygen values were recorded in the thermocline than in the epilimnion and hypolimnion. Mineral content increases from the upper to the lower end of Lake Mead; the greatest increase is in calcium and sodium sulfates and chlorides, although there is an overall decrease in bicarbonate. Filling of Lake Powell intensified the deterioration of water quality in Lake Mead during 1965, as evidenced by increased temperature, conductivity, and total dissolved solids and decreased dissolved oxygen. Las Vegas Bay reach was found to be a major source for degradation of water quality in Lake Mead because of its large input of dissolved salts and algae nutrients. The monitoring station at Hoover Dam has been a useful indicator of water quality in the lower reach of Boulder Basin.

R202758 67A

Hoffman, Dale A; Tramutt, Paul R; Heller, Frank C

WATER QUALITY STUDY OF LAKE MEAD

Bur Reclam Lab Rep ChE-70, Chem Eng Br, Nov 1967. 115 p, 37 fig, 10 photo, 11 tab, 7 ref, 3 append

Bureau of Reclamation, Denver, Colo

DESCRIPTORS- / dissolved oxygen/ electrical conductance/ temperature/ chemical analysis/ field tests/ laboratory tests/ field data/ salinity/ *limnology/ reservoirs/ *reservoir surveys/ test procedures/ *water analysis/ water management/ water sampling/ water supplies/ *water quality/ algae/ water pollution/ pH
IDENTIFIERS- / Lake Mead/ Boulder Canyon Project/ Lake Powell/ *water chemistry/ impoundments/ dissolved carbon dioxide

R202776X67A MISSOURI RIVER WATER QUALITY

Three papers are combined in a report summarizing the development of the Missouri River and planning for water quality controls. The first paper reviews the Missouri Basin hydroelectric flood control, irrigation, municipal water supply, bank stabilization and navigation projects, and discusses the effect of impoundments on water quality. The second paper describes the objectives, planning, and some operational features of the Missouri-Scouris-Red River Basins Comprehensive Water Pollution Control Program. These include the STORET computerized water quality data storage and retrieval system, contracted research on a computer model for water quality forecasting, collection of water quality data, and enforcement of water quality standards. The third paper covers protection of the public water supply. Pollution control, waste treatment, riverflow, water quality, and water treatment plants are discussed. Water quality standards should be consistent with 3 general principles: (1) The most important use of the Missouri River is for public water supply; (2) present quality of the water should be improved; and (3) the cost of waste treatment is the responsibility of the polluter, and should not be a burden on the downstream water industry.

R202776X67A

Love, R W; Young, Lewis A; Hartung, H O

WATER QUALITY IN THE MISSOURI RIVER--PROGRESS AND PROSPECTS

J Water Pollut Contr Federation, Vol 39, No 12, pp 1986-2007, Dec 1967. 22 p, 4 fig, 3 tab, 1 ref

Corps of Engineers, Omaha, Neb; Federal Water Pollution Control Administration, Kansas City, Mo; St Louis County Water Co, University City, Mo
DESCRIPTORS- / water analysis/ water management/ water pollution/ water requirements/ *water quality/ water supplies/ water treatment/ water utilization/ waste water/ sewage treatment/ public works/ *municipal water/ *pollution abatement/ stream pollution/ river basin development/ multiple purpose projects/ planning/ river regulation/ navigation
IDENTIFIERS- / Missouri River/ *Missouri River Basin/ waste water treatment/ *water pollution control/ Water Quality Act, 1965/ STORET

R202741 67A VIBRATION REDUCES CRITICAL VOID RATIO
A direct shear apparatus was mounted on a shaker table to show the effect of vibration on shear strength and void ratio of dry granular materials. Some work on the effect of vibration on soil properties is reviewed. Modifications of direct shear apparatus and test procedures used for the study are described. Two granular materials, 1/16-in.-dia steel balls and Ottawa sand passing the No 20 and retained on the No 30 sieve, were used in the investigation. The tests indicated that each vibratory equilibrium void ratio was also the critical void ratio when the sample was sheared under the same vibration. Vibratory equilibrium void ratio was defined as the ultimate minimum void ratio for a sample densified at a particular vibration. The critical void ratio and coefficient of internal friction were reduced considerably during vibration.

SOILS ENGINEERING

Youd, T Leslie

R202741 67A

REDUCTION OF CRITICAL VOID RATIO DURING STEADY STATE VIBRATION

Int Symp Wave Propagation Dyn Properties Earth Mater, Albuquerque, N Mex, Pap, Aug 1967. 18 p, 11 fig, 8 ref

Iowa State University, Ames

DESCRIPTORS--/ *vibrations/ *void ratios/ direct shear/ *shear strength/ granular materials/ apparatus/ test procedures/ sands/ critical density/ internal friction/ shear strain/ shear tests/ soil mechanics

IDENTIFIERS--/ vibration tables/ vibration tests/ Ottawa sand/ soil dynamics/ shakers/ strain rate

R202721X67A STRESSES AND STRAINS IN AN ELASTIC LAYER

Burmister's theory was used to obtain a set of influence factors for the stresses and surface displacements of an elastic layer with an underlying rough rigid base. Influence factors for point loading on the surface of the layer have been obtained for 4 values of Poisson's ratio. Corresponding influence factors for line, strip, and sector loading have been calculated by integrating these point load factors. Stresses given in each case are sufficient to define completely the stress distribution at any point in the layer. Accuracy of the influence factors has been examined and found to be quite satisfactory for practical engineering purposes. The sector method, involving superposition of sectors, is described and can be used to calculate stresses and displacements caused by any general shape of loaded area. The classical Boussinesq equations for a homogeneous semi-infinite elastic medium are commonly used to calculate the stresses in a soil mass; however, comparisons reveal that the Boussinesq stresses may be significantly less than the true stresses in a layer, especially near the base of the layer where a marked concentration of stress may occur. Has 21 references.

Poulos, H G

R202721X67A

STRESSES AND DISPLACEMENTS IN AN ELASTIC LAYER UNDERLAIN BY A ROUGH RIGID BASE

Geotechnique, Vol 17, No 4, pp 378-410, Dec 1967. 33 p, 49 fig, 9 tab, 21 ref, 2 append

University of Sydney, Australia

DESCRIPTORS--/ *stress distribution/ *displacements/ bibliographies/ Poisson ratio/ load distribution/ rigid boundaries/ *soil mechanics/ elastic theory/ charts/ stress/ numerical method/ mathematical analysis/ *elastic deformation

IDENTIFIERS--/ Boussinesq equation/ concentrated loading/ elastic foundations/ foreign research/ Australia/ influence lines

SOILS ENGINEERING

R202744 67A SOIL CONSTANTS FROM DYNAMIC TESTING
Several methods of determining the dynamic material constants of soils are described, with special emphasis on the elastic half-space method and the amplitude ratio method. Test results obtained by these various methods are presented to compare each technique and evaluate the various factors influencing the dynamic properties of soils. Factors considered are confining pressure, frequency, amplitude, degree of saturation, shape of footing, and depth of embedment. Comparison of the methods shows agreement in some areas and conflict and uncertainty in others. Tests indicate a variance of wave velocities with the 1/2 to 1/6 power of confining pressure. The effect of amplitude is such that the dynamic moduli are an inverse function of soil deformation induced by the input force. Use of a small- or large-scale vibrator on soils in situ is believed to be the most reliable way of determining the dynamic material constants of soils. Has 23 references.

R202744 67A

Chae, Yong Suk

THE MATERIAL CONSTANTS OF SOILS AS DETERMINED FROM DYNAMIC TESTING

Symp Wave Propagation Dyn Properties Earth Mater, Albuquerque, N Mex,
Tech Sess III, Pap, Aug 1967. 32 p, 6 fig, 23 ref

Rutgers--The State University, New Brunswick, N J

DESCRIPTORS-/ soil physical properties/ soil tests/ seismic properties/ dynamics/ soil mechanics/ *elasticity modulus/ bibliographies/ elastic deformation/ *vibrations/ vibrators (mechanical)/ field tests/ wave velocity/ laboratory equipment/ laboratory tests/ triaxial compression/ apparatus/ saturation

IDENTIFIERS-/ Ottawa sand/ *dynamic tests/ confining pressure/ elastic waves/ *soil dynamics/ in situ tests/ *shear modulus/ *shear waves

R202752X67A EARTH PRESSURE ON A RETAINING WALL

The stress state of soil behind retaining structures was investigated by using a large-scale model of a retaining wall under conditions approximating field conditions. The experimental wall was constructed of 8-cm reinforced concrete slabs in the form of a cellular structure 4.25 m high and 1.8 by 3.4 m in plan. Tests were conducted on a natural base of fine grain sand which was also used to create the lateral loads. Earth pressure was measured with a string of dynamometers manufactured and calibrated at the research department of Gidroproekt. The investigation indicated that the magnitude of lateral earth pressure is determined with sufficient accuracy by Coulomb's equation when the retaining wall can yield away from the backfill. When the wall is more stable, stresses in the upper and middle parts of the backfill appreciably exceed those calculated for the active state. Coefficients of lateral earth pressure are calculated for different test conditions and discussed.

R202752X67A

Fil'roze, R M

EXPERIMENTAL INVESTIGATIONS OF EARTH PRESSURE ON A RETAINING WALL

Hydrotech Constr, No 3, pp 268-271, Mar 1967. 4 p, 3 fig, 5 ref

DESCRIPTORS-/ lateral forces/ *earth pressures/ *retaining walls/ soil mechanics/ active pressures/ pressure measuring equip/ *pressure distribution/ pressure gages/ sands/ instrumentation/ backfills/ stress distribution/ model tests/ field tests/ *dynamometers

IDENTIFIERS-/ Coulomb theory/ *at rest pressure/ surcharge

R202760 67A INTERCORRELATION OF SOIL PROPERTIES

The method used and some preliminary results obtained in a study of the relationships among soil properties are presented. The method begins with the classification of different soils in groups according to the degree of response observed when a force is applied. After classification of the soils in groups an attempt is made to define these groups by means of soil properties as determined by accepted standard tests. When an unknown soil is encountered, the standard tests are performed. The soil is grouped with the inference that this soil will respond in a manner similar to other soils in the same group. A statistical analysis was performed on a large volume of test results available from various local organizations. The soil tests, including most of the standard physical properties tests, and the correlation procedures used in the study are given. Preliminary results are tabulated and appear to be promising. The influence of area climate on the maximum Proctor density and CBR value of the soil is illustrated conclusively.

R202760 67A

Van Rooyen, M

INTERCORRELATION OF ENGINEERING PROPERTIES OF SOIL

Proc Soil Mech Found Eng 4th Reg Conf Africa, Cape Town, South Africa, pp 203-207, Dec 1967. 5 p, 4 fig, 2 tab, 11 ref

University of Pretoria, South Africa

DESCRIPTORS-/ *soil physical properties/ correlation techniques/ soil classifications/ statistical analysis/ soil shrinkage/ *soil tests/ dry density/ plasticity index/ liquid limits/ California bearing ratio/ soil mechanics/ moisture content/ gradation analysis

IDENTIFIERS-/ foreign research/ South Africa/ soil groups/ correlation/ soil engineering

R202761 67A STATISTICAL CONTROL OF DRY DENSITY

A simplified statistical approach for the control of dry density in road construction is presented. In the proposed sampling scheme a method is outlined whereby engineering decisions can be made on the number of samples to be tested to satisfy various engineering requirements such as the error in test results and the desired limits of accuracy for a specified probability. Decisions based on the sampling scheme are used to define the requirements for the design, specification, and control of dry density in a road layer. By comparing the average density obtained from the specified number of observations with the specification density, a reliable decision can be made immediately concerning acceptance or rejection of the compacted layer. Criteria for determining the size of the area necessary for the desired number of test observations and the pattern of testing are discussed. An example problem illustrating the statistical control of dry density is given.

R202761 67A

Kuhn, S H and Burton, R W

STATISTICAL CONTROL OF DRY DENSITY

Proc Soil Mech Found Eng 4th Reg Conf Africa, Cape Town, South Africa, pp 191-194, Dec 1967. 4 p, 3 fig, 5 ref

National Institute for Road Research, Pretoria, Africa

DESCRIPTORS-/ *statistical analysis/ *quality control/ *dry density/ construction/ *embankments/ control/ soil compaction/ sampling/ soil mechanics/ soils

IDENTIFIERS-/ *construction control/ foreign research/ Africa/ standard deviation/ statistical quality control

SOILS ENGINEERING

R202762 67A ROCK TYPES AND THEIR DERIVED SOILS

Soils consist basically of material derived from parent rock by either in situ weathering or transportation. Under the correct conditions of climate and drainage resultant material can give rise to pedogenic material such as ferricrete, calcrete and silcrete. An attempt is made to indicate what degree of improvement or impairment in engineering properties can be expected for particular rock types when subjected to the 3 soil-forming processes. The possibility of making similar predictions for a group or a broad division of rocks such as igneous, metamorphic, and sedimentary types is examined. Tables classifying some rock types as roadbuilding materials are given. The conclusion is that a definite pattern of engineering behavior is characteristic for material formed from different divisions of rocks. Has 31 references.

R202762 67A

Floyd, G J

THE ENGINEERING SIGNIFICANCE OF THE RELATION BETWEEN ROCK TYPES AND THEIR DERIVED SOILS

Proc Soil Mech Found Eng 4th Reg Conf Africa, Cape Town, S Africa, pp 121-127, Dec 1967. 7 p, 1 fig, 4 tab, 31 ref

Kantey & Templer, Cape Town, South Africa

DESCRIPTORS-/- *rocks/ sedimentary rocks/ metamorphic rocks/ weathering/ igneous rocks/ soils/ *soil classifications/ transportation/ *materials forming/ *soil physical properties/ base courses/ granular materials/ gravels/ decomposition/ disintegration/ *residual soils/ engineering geology/ geologic investigations/ bibliographies
IDENTIFIERS-/- foreign research/ South Africa/ pedology/ *soil formation/ soil development

R202763 67A HORIZONTAL STRESSES IN LACUSTRINE CLAYS

Conditions of horizontal stress in 2 lacustrine deposits of stiff fissured clay overconsolidated by desiccation are investigated. The first profile is saturated fully with the water table at the surface while the second is in a desiccated and partly saturated condition with a deep water table. References to prior work are given that report values of K sub zero greater than 1 and the horizontal effective stress approaching the passive pressure resistance of a clay. This situation was found to exist in the saturated fissured clay with the water table at the surface. If the clay becomes desiccated because of a lowering water table and if the shrinkage is large as the clay dries out, the horizontal effective stress will decrease. Consequently, horizontal stresses at rest in expansive clays with a lacustrine origin will be lower generally than the minimum passive pressure resistance of the clay, even when the clay has heaved fully beneath a covered surface.

R202763 67A

Blight, G E

HORIZONTAL STRESSES IN STIFF AND FISSURED LACUSTRINE CLAYS

Proc Soil Mech Found Eng 4th Reg Conf Africa, Cape Town, S Africa, pp 95-99, Dec 1967. 5 p, 3 fig, 13 ref

National Building Research Institute, Pretoria, South Africa

DESCRIPTORS-/- *lacustrine deposits/ *clays/ fissures/ stress/ earth pressures/ passive pressures/ effective stress/ *overconsolidation/ soil profiles/ swelling/ soil mechanics/ water table/ saturation/ vane shear tests/ shear tests/ pore pressures/ cohesion/ internal friction/ overburden
IDENTIFIERS-/- *at rest pressure/ foreign research/ South Africa/ slick spot soils

R202767 67A MULCHES FOR GRASS ON STEEP SLOPES

Thirteen mulch treatments were evaluated on plots seeded to Lincoln bromegrass on a 3 to 1 roadside backslope in September 1965. Plots protected with excelsior mat, prairie hay anchored with a loose paper netting, or a combination of emulsifiable asphalt as an anchorage for woodchips, chopped corncobs, prairie hay, or wood cellulose had significantly more grass cover than did the no-mulch treatment 1 month after seeding. Although differences in soil moisture percentages and soil temperatures between mulch treatments were statistically significant, these factors apparently had no great practical effect on seedling grass stands--with one exception. The poor stand of grass on the plots mulched with emulsifiable asphalt may have been due to high soil temperatures and the wide range between soil temperature extremes. The rate of 1200 gal/acre also may have been excessive for good germination. Differences among mulches probably would have been greater under conditions of normal, or preferably below normal, precipitation. The most effective mulches 1 year after seeding were excelsior mat, prairie hay anchored with a light paper netting, and prairie hay anchored with emulsifiable asphalt.

R202767 67A

Dudeck, A E; Swanson, N P; Dedrick, A R

MULCHES FOR GRASS ESTABLISHMENT ON STEEP CONSTRUCTION SLOPES

Highway Res Rec, No 206, pp 53-59, 1967. 7 p, 5 tab, 5 ref

University of Nebraska, Lincoln

DESCRIPTORS.. / *grasses/ *slopes/ *cuts/ *slope protection/ vegetation/
 *soil erosion/ erosion/ soil moisture/ temperature/ emulsions/ asphalt/
 protective coatings/ soil stabilization/ rainfall/ atmospheric
 precipitation/ highways

IDENTIFIERS.. / *mulches/ *mulching/ *roadsides/ *slope stability/ hay/
 vegetal cover

R202768 67A SLOPE PROTECTION AGAINST WATER EROSION

Mulching practices on a roadside cut with 3 to 1 slope were evaluated for controlling soil erosion and minimizing grass seed and fertilizer loss prior to grass establishment. A field plot rainfall simulator and a device to introduce additional surface flow over a test plot were used to evaluate the mulching practices. Measurements of soil erosion and grass seed and fertilizer losses were made from runoff samples taken through a series of simulated rainstorms. The effectiveness in protecting soil surfaces against water erosion was determined for 13 mulches. The best protection was provided by mulches of jute netting, wood excelsior mat, prairie hay (1 ton/acre) and fiberglass (1000 lb/acre) anchored with asphalt emulsion (150 gal/acre). The least effective mulches were the latex (150 gal/acre) and a kraft paper netting. Anchoring a material with asphalt emulsion provided increased adherence to the soil surface and was generally beneficial.

R202768 67A

Swanson, N P; Dedrick, A R; Dudeck, A E

PROTECTING STEEP CONSTRUCTION SLOPES AGAINST WATER EROSION

Highway Res Rec, No 206, pp 46-52, 1967. 7 p, 1 fig, 4 tab, 3 ref

U S Department of Agriculture; University of Nebraska, Lincoln

DESCRIPTORS.. / *slope protection/ *slopes/ *soil erosion/ grasses/ *cuts/
 *erosion/ fertilizers/ soil stabilization/ seeding/ emulsions/
 protective coatings/ artificial precipitation

IDENTIFIERS.. / rainfall simulators/ *mulches/ *mulching/ raindrop splash/
 simulated rainfall/ *roadsides/ *slope stability/ vegetal cover

SOILS ENGINEERING

R202783 68A SOIL PRESSURE ON BURIED STRUCTURES

An investigation was conducted to evaluate the important variables of the soil-structure interaction problem. This problem has been defined in terms of 2 types of load redistribution: load redistribution between the structure and soil, and pressure redistribution across the structure. A review of literature related to the investigation is given. The experimental model structures used in the investigation were buried in a dry, clean, medium sand. The tests were conducted in an airtight steel cylinder, 8 ft high and 30 in. in diameter, enabling the models to be loaded by air pressure. Pressure redistribution on the structure varied as a function of applied surface pressure and depth of burial, whereas redistribution to the adjacent soil was dependent upon depth of burial alone. Parameters affecting the soil-structure redistribution and structural redistribution were correlated, and the significance of each is discussed. After the pressure redistribution mechanism is established by a seating pressure, which is dependent upon depth of burial, the final attenuation of pressure varies with burial depth for the structural redistribution and with the square root of burial depth for the soil-structure redistribution.

R202783 68A

Linger, Don A and Fernandez, Pedro

SOIL PRESSURE DISTRIBUTIONS ON BURIED STRUCTURES

Pap, 47th Annu Meeting, Highway Res Board, Washington, DC, Jan 15-19, 1968. 41 p, 18 fig, 7 ref

University of Arizona, Tucson

DESCRIPTORS-/- *soil pressures/ *pressure distribution/ instrumentation/ *load distribution/ model tests/ apparatus/ laboratory tests/ structural models/ air chambers/ shear failures/ bending moments/ deformation/ *soil mechanics/ sands/ underground structures/ culverts

IDENTIFIERS-/- *soil-structure interaction/ soil arch/ *buried structures

STRUCTURAL AND ARCHITECTURAL ENGINEERING

R202728X67A DESIGN OF PRESTRESSED CONCRETE MEMBERS

Development of a practical aid for designing standard prestressed concrete members permitting an exact, immediate, and complete graphical design of any uniformly loaded simple span is presented. The graphs visually outline the interaction of all design parameters affecting prestressed concrete; i.e., prestress force, camber, release strength, top tension, bottom tension, deflection at various stages of loading, and ultimate strength. The method developed is general and can be applied to any standard prestressed member. Three design examples are given to illustrate use of the graphs. The method has proven particularly valuable in estimating. Selection of final strand patterns for any span and loading condition can be made without performing a single calculation.

R202728X67A

Jacques, Francis J

GRAPHS FOR THE DIRECT DESIGN OF PRESTRESSED CONCRETE MEMBERS

J Prestressed Concrete Inst, Vol 12, No 6, pp 61-76, Dec 1967. 16 p, 9 fig

Prestressed Concrete of Colorado, Inc, Denver

DESCRIPTORS-/- *prestressed concrete/ design/ *design tools/ *graphical analysis/ codes/ prestressing/ beams/ programs/ concrete/ stressing cables/ tension/ ultimate tensile strength/ charts/ slabs/ structural members/ deflection/ loads/ structural design

IDENTIFIERS-/- camber/ T-beams/ computer printouts/ *ultimate strength design/ concrete properties

R202735 67A NATURE OF PRESTRESSED STEEL STRUCTURES

Principles governing the design, application, construction, and behavior of prestressed steel beams are discussed. Only one type of pre-stressing is considered, that of using cables, strands, or rods. Several types of prestressed beam structures are considered, including I-shaped, composite, and continuous beams. In each case behavior of the structure is presented, along with comments on the possible economy to be achieved. A comparison is given between conventional and prestressed composite beams, and results show promise for prestressing. Effects of prestressing in significantly reducing bending moments in continuous beam construction are discussed. The moment diagrams for a typical 3-span continuous highway bridge show the magnitude of the reduction that can be realized by using prestressing. Shear is not likely to be any more important in a prestressed structure than in a conventional one. Several examples of existing structures containing prestressed members are given.

R202735 67A

Hoadley, Peter G

THE NATURE OF PRESTRESSED STEEL STRUCTURES

Highway Res Rec, No 200, pp 11-27, 1967. 17 p, 14 fig, 4 tab, 10 ref

Vanderbilt University, Nashville, Tenn

DESCRIPTORS-- / *prestressing/ *steel structures/ *structural members/
design criteria/ structural engineering/ structural design/ *structural
steel/ composite structures/ design/ cables/ rods/ beams/ continuous
beams/ economics/ bending moments/ building materials/ elastic
deformation/ stressing cables/ stress
IDENTIFIERS--/ prestressing systems/ I-beams/ composite beams

R202742X67A FAILURE PROBABILITIES IN DESIGN

The choice of an optimum level of structural safety for 1 type of failure is formulated on the basis of the minimum expected loss criterion applied to an idealized basic scheme. Limits of sensitivity to initial costs are introduced and shown to lead to limits on sensitivity to failure probability. A rigorous decision is compared to an approximate criterion based on effectively zero failure probability for a variety of cases. In many practical situations the simple criterion is at worst a slightly conservative approximation to the formal solution. Gives 15 references.

R202742X67A

Turkstra, Carl J

CHOICE OF FAILURE PROBABILITIES

Proc Amer Soc Civil Engs. J Struct Div, Vol 93, No ST6, Pap 5678, pp
189-200, Dec 1967. 12 p, 1 fig, 5 tab, 15 ref, append

McGill University, Montreal, Canada

DESCRIPTORS-- / *safety/ *probability/ *failure (mechanics)/ *structural
design/ bibliographies/ structural engineering/ design/ decision making/
optimum design/ economics/ foreign design practices

IDENTIFIERS--/ Canada

STRUCTURAL AND ARCHITECTURAL ENGINEERING

R202743X67A COMPUTER ANALYSIS OF LARGE FRAMEWORKS
Writing efficient methods of solving simultaneous equations resulting from a linear structural analysis of large frameworks is discussed. Gaussian elimination is considered, and numerous computational variations based on this method are developed. Each method is written to take advantage of some or all of the properties of the stiffness matrix. Solution routines are classed into two distinct groups and use either magnetic tape or need only the working store. The magnetic tape program involves matrix partitioning, performed internally by the computer. Two methods of solution are based on single coefficient eliminations, and two are based on simultaneous elimination of groups of coefficients in the form of submatrix stiffness blocks. Comparisons are made among various methods, and rules are formulated which will permit automatic selection of the appropriate solution routine for a given problem. Has 21 references.

R202743X67A

Brooks, David F and Brotton, Derick M

COMPUTER SYSTEM FOR ANALYSIS OF LARGE FRAMEWORKS

Proc Amer Soc Civil Eng. J Struct Div, Vol 93, No ST6, Pap 5632, pp 1-23, Dec 1967. 23 p, 12 fig, 4 tab, 21 ref, 2 append

University of Manchester, Great Britain

DESCRIPTORS-/- *computers/ frames/ *structural analysis/ structural engineering/ bibliographies/ mathematical analysis/ numerical method/ stiffness/ magnetic tapes/ charts/ *structural design/ digital computers/ computer programming

IDENTIFIERS--/- matrix methods (structural)/ Gaussian distribution/ foreign research/ *space frames/ Great Britain

R202771X68A CELLULAR FLAT PLATE CONSTRUCTION

A relatively new method of concrete flat plate construction using a cellular or hollow design is described. It is distinguished from ordinary waffle slab construction in that a continuous integral bottom sheet of structural concrete completely cellularizes the flat plate. The advantage of cellular construction in reducing deadweight combined with a use of deeper sections makes possible increased span lengths for the same live load as compared to conventional flat plate construction. Spans ranging from 20 to 85 ft using overall plate depths from 14 to 48 in. are possible with this method. Other advantages of the system include a finished ceiling exposed with the stripping of the formwork, slabs with relatively high resistance to heat transmission, good sound damping qualities, elimination of hung ceilings since all required conduits can be embedded, and flexibility in design to support a wide range of loadings. Design and construction techniques used on the system are discussed.

R202771X68A

Hendler, Edgar H

CELLULAR FLAT PLATE CONSTRUCTION

J Amer Concrete Inst, Vol 65, No 2, pp 81-86, Feb 1968. 6 p, 5 fig, 2 tab, 4 ref

George M Ewing Co, Philadelphia, Pa

DESCRIPTORS-/- *cellular structures/ *flat plates/ *concrete structures/ *slabs/ concrete/ *structural engineering/ dead loads/ live loads/ fire safety/ *reinforced concrete/ thermal properties/ conduits/ fillers/ plastics/ building codes/ structural design/ foreign design practices/ acoustic insulation

IDENTIFIERS--/- construction methods/ sound dampers/ plastic foam/ West Germany

R202746 67A PERMEABLE RESERVOIR SITES

A combination surface and underground municipal water supply project is being planned for Pardubice, Czechoslovakia. An artesian basin about 19 km from the city is being developed as a water source but is not sufficient for future requirements. Most of the convenient surface reservoir sites are located on permeable sandstone. In the past, such reservoir sites have been abandoned because of high seepage losses. A new approach to the problem permits utilization of permeable reservoir sites. Hydrogeological investigations showed that the proposed Luz Reservoir would be a natural ground water collection zone for the artesian basin. Investigations are described for determining the feasibility of using the reservoir for surface water storage with the reservoir seepage artificially recharging the artesian basin.

R202746 67A

Zajicek, Vaclav

HYDROLOGICAL DOCUMENTATION FOR THE EXPLOITATION OF RESERVOIRS IN PERMEABLE SOLID ROCKS FOR THE PURPOSE OF ARTIFICIAL INFILTRATION

Symp Int Union Geod Geophys-Int Ass Sci Hydrol, Haifa, Israel, pp 124-131b, Mar 1967. 10 p, 4 fig, 1 tab, 5 ref

Hydraulic Research Institute, Prague, Czechoslovakia

DESCRIPTORS-/- ground water/ groundwater geology/ *groundwater recharge/ engineering geology/ hydrology/ water storage/ *water collection systems/ *water supplies/ subsurface investigations/ seepage/ artesian water/ infiltration/ *underground water storage/ aquifers/ *reservoirs/ foreign projects/ permeability/ feasibility studies
IDENTIFIERS--/- Luz Reservoir, Czech/ Pardubice, Czechoslovakia/ artificial replenishment/ Czechoslovakia

R202751 67A AQUIFER MANAGEMENT

Scarcity of naturally available water resources in many parts of the world points out the need for more sophisticated water management techniques. Rules governing the operation of aquifer and surface water components of regional systems are quite complex. In such cases, optimal operating rules may be derived through the application of systems engineering. Mathematical techniques, collectively termed as operations research, are used for the analysis and solution of problems. The techniques used in optimization include simulation methods and linear, nonlinear, and dynamic programming. Examples of the systems approach to water management in southern California, the Indus Valley, and Israel are discussed. In all cases, the aquifers are viewed as components of complex water systems and use is optimized within the overall system. Application of systems engineering to aquifer management is in the exploratory stage. Further research could refine the analytical techniques used in the management of water resources. Has 33 references.

R202751 67A

Buras, Nathan

SYSTEMS ENGINEERING AND AQUIFER MANAGEMENT

Symp Int Union Geod Geophys-Int Ass Sci Hydrol, Haifa, Israel, pp 466-473, Mar 1967. 8 p, 2 fig, 33 ref

Israel Institute of Technology, Haifa

DESCRIPTORS-/- *water management/ water resources/ operations research/ water sources/ water supplies/ bibliographies/ *water utilization/ reservoirs/ *ground water/ aquifers/ optimum use/ mathematical analysis/ scientific method/ *systems analysis/ foreign projects/ computer programming/ digital computers/ project planning
IDENTIFIERS--/- Israel/ Los Angeles Coastal Plain/ Indus Basin, Pakistan/ mathematical models/ *groundwater management/ *optimization

MISCELLANEOUS

R202733X68A REMOTE SENSING OF NATURAL RESOURCES

Several devices are now available to supplement the aerial camera in detecting natural resources; e.g., radar, gamma ray detectors, and sensors of infrared energy. The name often given the technique employing these devices is remote sensing. Remote sensing can be done from aircraft or spacecraft, including unmanned satellites. To some extent the data obtained by the sensing devices can be processed and interpreted automatically, permitting a large volume of information to be dealt with rapidly. Remote sensing of natural resources is possible because every feature of the terrain emits or reflects electromagnetic energy at specific and distinctive wavelengths. A discussion on analysis and application of the data obtained from remote sensing is given. Some of the equipment and related devices used by the technique are discussed.

R202733X68A

Colwell, Robert N

REMOTE SENSING OF NATURAL RESOURCES

Sci Amer, Vol 218, No 1, pp 54-69, Jan 1968. 16 p, 5 fig, 43 photo

University of California, Berkeley

DESCRIPTORS.. / *aerial photography/ *natural resources/ *photogrammetry/
geologic investigations/ photographic equipment/ soil surveys/ sensors/
*infrared rays/ gamma rays/ satellites (artificial)/ waves/ radar/
photography

IDENTIFIERS.. / airborne equipment/ *remote sensing/ color photography/
photointerpretation/ photographic analysis/ infrared imagery

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